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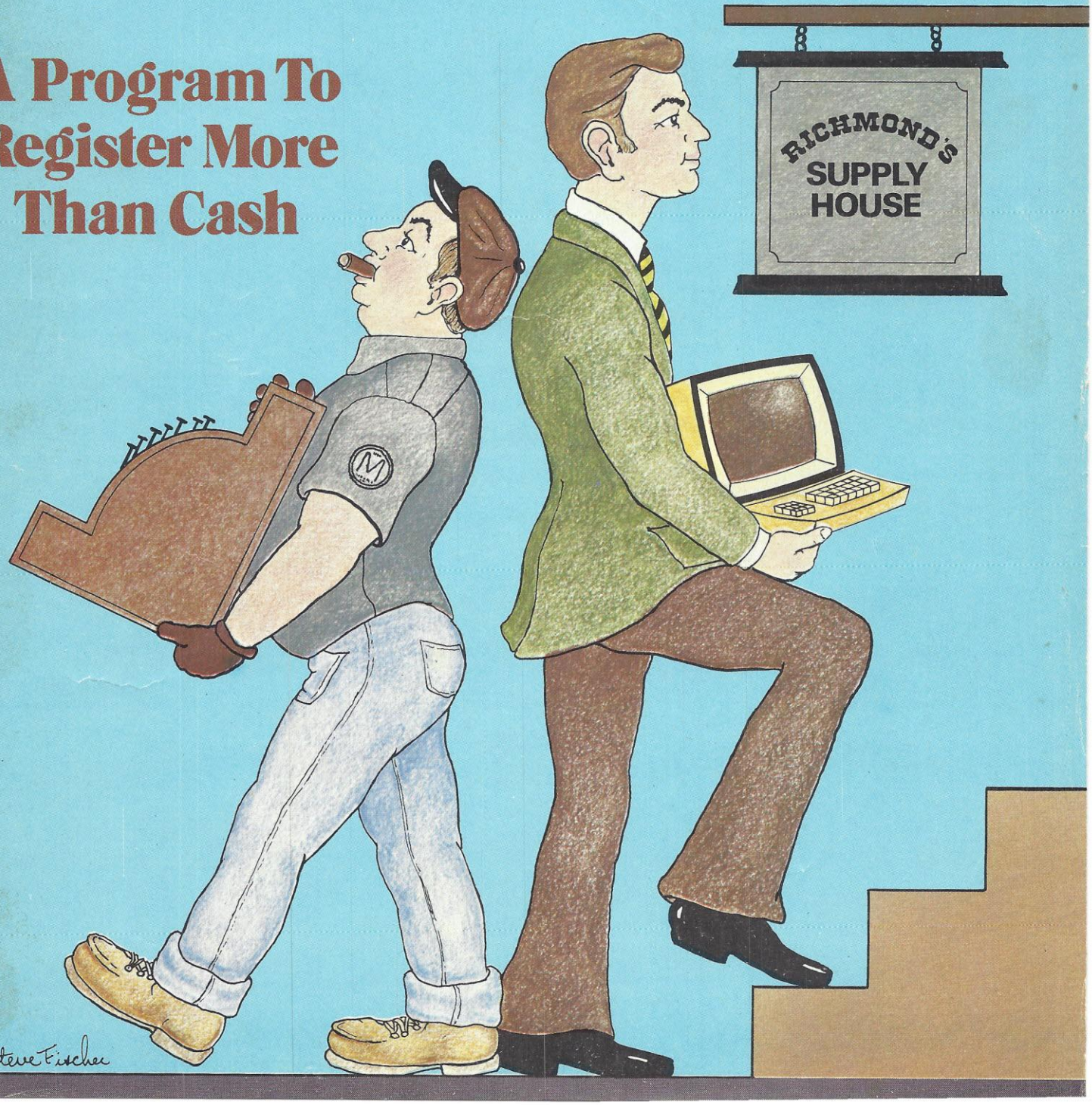
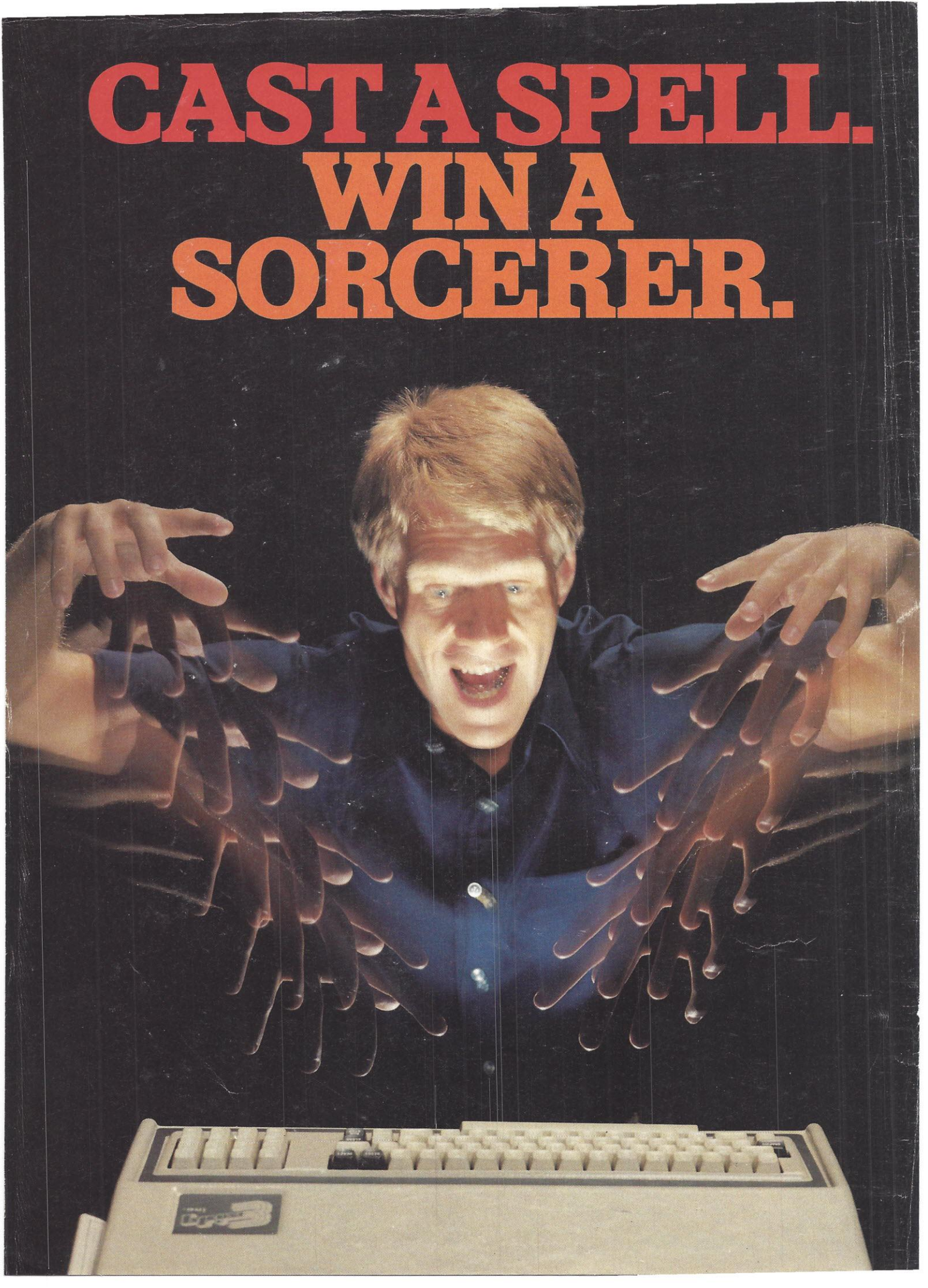
Personal Computing

For Your Home and Business

A Program To Register More Than Cash



CAST A SPELL. WIN A SORCERER.



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Test-run your entry free. Take your program to any participating Sorcerer dealer if you want to give it a test run. At the same time, maybe you'll want to jazz up your program to take advantage of Sorcerer's state-of-the-art features. These include 512 by 240 high-resolution graphics; user-defined characters; and dual cassette I/O, among others.

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RULES:

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2) Enter as many times as you like. This coupon, or a copy of it, must be completed and attached to all entries.
3) Enter at any participating Exidy Sorcerer dealer, or mail entries postpaid to the address on this coupon.
4) Entries must be received by midnight, Aug. 31, 1979. Winners will be notified by Nov. 30, 1979. For a list of winners, send a self-addressed, stamped envelope marked "Winners List" to the coupon address.
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7) Judging will be by a panel of experts chosen by, and including representatives of, Exidy, Inc. Judges may assign programs to whichever entry category they consider appropriate. Decision of the Judges is final.
8) Employees of Exidy, Inc., its dealers, distributors, advertising agencies and media not eligible. Void where prohibited, taxed or restricted by law.

Exidy inc.

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CIRCLE 1

SIGNATURE _____ DATE _____

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- **An infinite number of challenging "QUIZ" for him and for you.**
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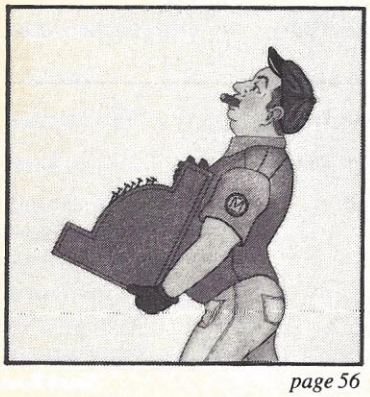
CIRCLE 6

JULY 1979 Vol. III No. 7

Personal Computing

For Your Home and Business



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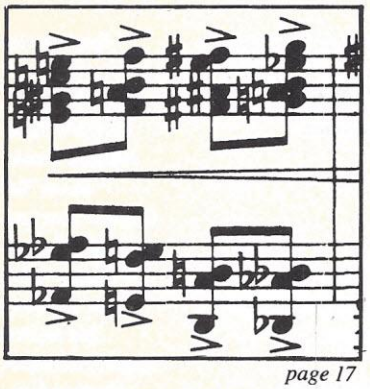

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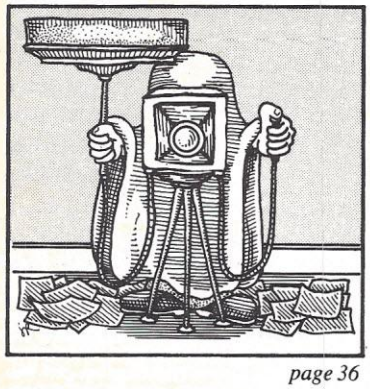

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COVER STORY

LAUNCHING PAD

DIGGING IN

ON THE LIGHTER SIDE

ONCE UPON A TIME

DEPARTMENTS

Cover Illustration by Stephen C. Fischer

Publication Number USPS 370-770

Personal Computing

JULY 1979 Vol. III, No. 7

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CIRCLE 44

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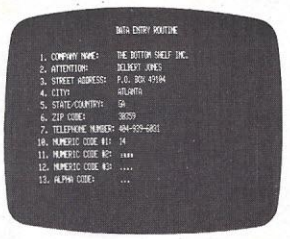

For your 32K, two disk drive and printer TRS-80, an endless mailing list!

MAIL LIST keeps 500 names and addresses per disk, together with three numeric codes and one alphabetic code for each name. 500 records per disk, and any number of disks that you wish. MAIL LIST keeps all entries in zip code and then last name order, and keeps track of which disk is holding which items. Automatic prompts instruct the operator as to which disk should be inserted. Selectable printouts for labels or other lists for hard copy storage. Full EDIT, DELETE, and other commands for your operators convenience. See SYSTEMS EXTENSIONS or your dealer for full details. **The first TRS-80 batch-processing program.**

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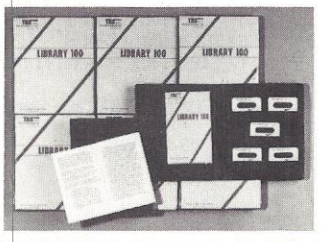
Library 100 — $49.50

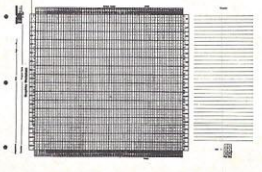


The Library 100 was designed to fulfill your general TRS-80 Level II programming needs. Using advanced Level II techniques and rigid quality control, The Bottom Shelf has been able to make available 100 programs on five guaranteed-to-load cassettes, which load over a wide range due to advanced recording techniques and methods designed by engineers for The Bottom Shelf. The programs include applications in five areas: Business and Finance, Education, Graphics, Home and Games.

As an added bonus, you get Tiny PILOT, the first new high-level language for the TRS-80. It's perfect for teachers, parents, students and sales trainees.

Using only six of Tiny PILOT's commands, even a child can program in minutes.

TBS Pad System — $19.95 set of five



Programmers pads, 11½"x 17". Punch for insertion and storage in a standard three ring notebook binder. All necessary indexes and numbers for your programming convenience on a 16 x 64 CRT.

Systems Extensions — $3.00

Systems Extensions is published and marketed by TBS, creators of the LIBRARY 100. The articles published in Systems Extensions were written by our staff of TOP QUALITY PROGRAMMERS at TBS, to aid you with your computer. Also incorporated in this publication is a group of over 300 items designed to support your computer system.

Partial Table Of Contents

1. Computers of the Past
2. Computers the Present and Next Two Years
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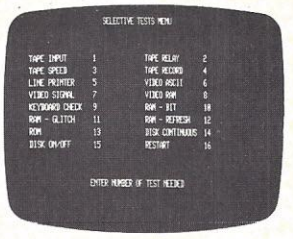
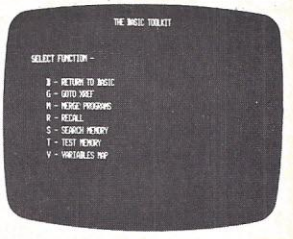


Now you can check your TRS-80 Level II computer and all it's peripherals with this program. SYSTEM DOCTOR allows you to selectively test any function or peripheral or continuously test your system. Run this program once a week or when trouble occurs. Be your own computer diagnostician.

The Basic Toolkit — $19.80

By F. Barry Mulligan



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- WILL MERGE PROGRAMS ON A CASSETTE BASED SYSTEM!
- Will search memory for all occurences of a specific byte and list the locations where it appeared.

This program can be accessed at any time while you are programming by hitting SHIFT/BREAK.

Be a participating TBS dealer. Phone: 404-939-6031

See your local TBS dealer, over 100 nationwide. Master Charge or Visa accepted. All orders plus $2.00 P & H. Add 4% tax, if Georgia. Above software for TRS-80 L II.

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CIRCLE 5

EDITOR'S MEMO

As we were going to press, we learned that World Power Systems, a company that advertised in the June PC with a six-page insert, is a bogus operation. The company received equipment from suppliers without paying for it; and received orders from customers without delivering. The full story, as known at this time, is given in the article below, reprinted with permission from the May 14 issue of Computerworld.

We'll repeat this notice, with updates, in the next several issues to warn our readers not to respond to the bogus company's ads. — The Editors

Bogus Micro Company Uncovered

By Ann Dooley

TUCSON, Ariz. — World Power Systems, Inc., a bogus microcomputer firm here, abruptly ended its alleged consumer fraud recently when it became clear that discovery was imminent.

A mail order firm, World Power advertised I/O boards, interfaces and so forth in several hobby magazines and collected money for orders, but never filled them.

The alleged perpetrator of the scheme is reported to have fled the area, leaving behind money and computer equipment — valued at $100,000 to $250,000 — in his haste to elude authorities.

The man suspected of masterminding the hoax was involved in several swindles in the computer and electronics industries. He is already wanted by California authorities for escaping from Chino State Prison, where he was serving a three-year sentence for a similar rip-off.

The suspect, Norman Henry Hunt, was using the alias of James Anderson in this computer hoax, but also called himself Col. David Winthrup, Harold Bender, Robert Renfro and William Scoville, authorities said.

In 1977, using the name Winthrup, Hunt established a firm called Datasynch, selling terminals and related equipment through the mail. All the equipment was later found to be simple mock-ups, incapable of operation. Hunt was convicted, but escaped form the California prison and went to Tucson, where he established the new company, allegedly using the techniques he employed in the Datasynch swindle.

Hunt apparently established World Power at the beginning of this year and began advertising his equipment in *Interface Age*, and *Creative Computing*, authorities said. Anderson bought six pages of ad space in each magazine, running ads that featured a computer hobbyist, his wife and the computer equipment he had supposedly developed.

The man in the advertisements, George Perry Pollock, allegedly collaborated with Hunt in the rip-off scheme and was arrested while trying to move out some of the computer equipment left in Hunt's house.

Hunt's advertised products included some Radio Shack TRS-80-compatible equipment and an I/O board. Suspicion was aroused when a *Creative Computing* staff member realized that no circuit etches were shown on the I/O board pictured in the advertisements.

Creative Computing Editor John Craig called the company and asked if he could pay a visit. An appointment was arranged, but on April 25, two days after Craig's phone call, Hunt cleared out. Upon hearing Craig's name, Hunt apparently became suspicious; the two knew each other during the time of the Datasynch swindle.

Hunt and his wife, Lee, induced two of the company secretaries to accompany them, saying they were going to start an office elsewhere. Afer several days of aimlessly driving around Texas, both women returned to Tucson.

In the meantime, one woman's father became suspicious and reported the matter to the police, who secured a search warrant and began watching Hunt's abandoned office and home.

The two secretaries claimed they were kept so busy they had no idea what was going on and are believed by authorities to be innocent.

"Winthrup has been a con man all his life and is very, very good at it," Craig stated. His technique is to establish credibility and then "take the money and run." It's what's known as a "bust out" by police, he noted.

Although so far it is unknown how much money is involved in this latest "bust out," Hunt allegedly managed to swindle a significant amount of money from numerous people before being forced to close his operation.

The hobby magazines in which Hunt advertised were not paid for the space used. The hobbyists who sent money expecting to receive the advertised equipment, the computer parts firms that sold Hunt components on credit and the dealerships that paid Hunt to distribute his fraudulent equipment may never be paid back.

If the "bust out" had not been cut short, Hunt would have kept collecting money and equipment while maintaining an appearance of respectability, Craig said. Then, after several months, he would have taken the money and traveled to another state to sell the unpaid computer equipment.

The whole swindle usually lasts several months before it is dissolved, Craig said, noting that this scheme was probably broken up a month before Hunt planned to end it.

The Pima County Attorney's Office, the Department of Public Safety and federal postal inspectors are investigating the case because mail fraud was involved. Susan Moore, criminal investigator for the county attorney's office, was the official who arrested Pollack on a conspiracy and fraudulent scheme (or artifice) charge. Pollock is awaiting a grand jury hearing.

Hunt, whose swindles have been staged in Nevada, Texas, Arizona, California and Georgia, was last seen in Oklahoma and is believed to be heading northeast.

FEEDBACK

Bugged By Bugs

Editors:

I have long shared the view so well expressed by Richard Straw in your April 1979 Feedback department that all published programs have bugs, but am amazed anew each month at how little progress is made in eliminating them.

For example, on page 43 of your April issue is a cash flow program that doesn't work at all. The two-letter variables are nonstandard but easy to change, and the fact that there must be 101 values of I starting at I(0)=0, although I is dimensioned at 100 and I(0) is not initialized, are perhaps dialect differences that will allow the program to run on some systems.

The serious error is in line 190, since the numerator of the expression to be added to SM should be CF(L), the current year's cash flow, not CF(K), the final year's cash flow.

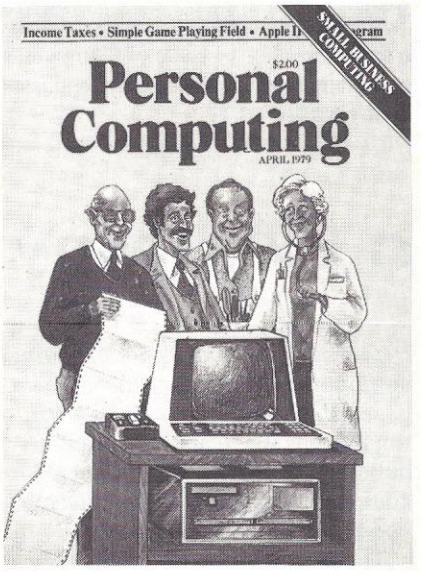
Once debugged, the cash flow program is effective and useful, but extremely slow. You can speed up the program by altering line 215 to provide for an exit from the loop once the increment in the interest rate is less than some chosen value, with the increase in speed being proportional to the error tolerated. Allowing an error of 1/1000 of 1% increases the speed by a factor of 8 or so; and since the data will ordinarily be estimates anyway, there is no reason to pretend to more exactitude. It is best if allowing an error to truncate the output to the precision of the calculation, so two lines should be changed, as follows:

```
215 IF ABS (I(J)-I(J-1))<1E-5 THEN
        GOTO [or EXIT] 240
240 PRINT INT (1E5*I(J)+.5)/1000;"%"
```

J. Lester Parsons, III
Bernardsville, NJ

Author's note: I must agree with J. Lester Parsons and others who feel that published programs *should* be error-free. In this instance we clearly failed to achieve that goal.

I believe there are 101 available values, I(0) through I(100). I(0) plays



no role since we use I(J) for J=1 to 99. That loop starts at I(1), which we set to 1. On the PET, all values are initialized to zero by the RUN command.

Line 190 does contain an error, as Mr. Parsons suggests, and he fixes it by changing index K to L. My program contains the correct value, but, sadly, the *typed* copy did not.

Mr. Parsons' fix for Line 215 seems fine to me — if it's important to a user. As the article points out, you should solve the problem in a satisfactory (not necessarily best) way. I did not need a faster version since the suggested program saves about one man-hour compared to the chart format previously used.

Other typos of consequence include: a dropped right parenthesis in the EOQ formula and use of FY instead of Y in the first note to the line number table. Also, L is average asset *life* in the ROIAD Variable List.

—Kirtland H. Olson, P.E.

Merging on the Challenger

Dear Editor:

I am the proud owner of a new Ohio Scientific Challenger 1P. The 1P uses Microsoft 8K BASIC, the same type as the PET. I have found a statement in Mr. Zimmerman's article, "Line Renumbering on the PET" (*PC*, March '79) to be erroneous, at least on my machine. He states that "there doesn't seem to be any way to load and merge two BASIC programs." This is true, of course, if the programs have conflicting line numbers. Obviously, though, in Mr. Zimmerman's case, some effort has been made to avoid this.

It is possible to load and merge programs on the Challenger 1P. The procedure is the same as if you were loading a single program, except that when you finish LOADing one, you LOAD the other. In between, I have found, you may RUN, LIST, break (reset) or go see a movie, without any trouble at all.

In fact, I have written a set of programs for such tasks as drawing cards and rolling dice, and have started them at high line numbers. Thus, I could, while I was working on a game program, for instance, LOAD one or more of these utility programs and use them as subroutines.

I would like to thank Mr. Zimmerman for his fine article; it provided me with greater insight as to how my BASIC works.

Paul McKee
Lynchburg, VA

Author's note: Alas, it's not quite so easy to merge two BASIC programs in a PET! I know of three methods: (1) A short program may be LISTed on the screen and kept there while another program is loaded. Then, the screen editor allows the merger to take place with only a few keystrokes. (2) A machine-language program named MERGER, by Jim Russo and Henry Chow, allows two programs from tape to be united. See Gene Beals' *Pet User Notes*, Vol. 1, Issue 7 for details (P.O. Box 371, Montgomeryville, PA 18936). (3) A clever programming procedure by Jim Butterfield, called UNLIST merges a program on a specially-prepared data tape with another program resident in memory. See Beals' *Pet User Notes*, Vol. 1, Issue 6, or *Micro* magazine, issue No. 8 (P.O. Box 3, S. Chelmsford, MA 01824).

Thank you for your kind comments about the article!

— Mark Zimmerman

Line Renumbering on the OSI

Dear Editors,

I find your magazine refreshing in its contents as it contains a blend of subject matters. I am still new to personal computing and have very much to learn. Publications such as yours make this learning process more enjoyable and rewarding. I also feel that learning is a sharing process and would like to pass on a little bit of knowledge that I gained while playing with my new toy.

First I wish to compliment Mark Zimmerman for a fine article and program on "Line Renumbering on the PET" (March 79). The piece was well documented and well written. The completeness of the information provided led me to try the program on my machine, an Ohio Scientific C2 4P.

The first step was to verify that the starting point in memory was at location 1024 as it is in the PET. This was not the case, as my OSI C2 4P has less information stored up front in its memory. The starting point is at address 769 (300 hex). This necessitated changing line 63010 so that "AH=4" is now "AH=3." With no other modifications the first half of the program will now run in my machine.

The next step was to seek out the token which represented GO TO, THEN,"," (comma) and GOSUB. I entered a short, meaningless program and searched the memory in the monitor mode to find the correct numerical value of these tokens. It turned out that they were close to what the PET used as GO TO=136 (88 hex), THEN=160 (A0 hex) and GOSUB=140 (8C hex). The comma was the same, 44 (2C hex), which is ASCII code. Thus, line 63540 must be changed to:

```
63540 IF CH<>160 ANDCH<>140
ANDCH<>136 THEN GOTO 63520
```

I then changed the end of line 63510 to read L=768, the end of the initializing routine for BASIC. At this time it looked as if the program could run, but I hit a few snags.

First, the status reporting statements in lines 63810 and 63830 are too long to fit on a single line, and putting the "GOTO" statements on a new line caused the program to crash. So, I set up two strings on preceding line numbers:

```
63805 Q$="COULD NOT FIND LINE
          NUMBER"
63825 QQ$="NO ROOM TO
          REPLACE".
```

I then simply said in line 63810 to print Q$ and in line 63830 to print QQ$ in place of what the strings were equal to.

The second bug was again due to how the machine language is implemented in a BASIC program. At the end of each line number (address) is a zero (0) that caused the program to see the end of the line where it was just beginning. The program would then increment to the next address, "thinking" that it was at the end of the line. To correct this, a new line was added: 63525 Q=1. Then line 63530 was changed to:

```
63530 L=L+1:CH=PEEK(L): IF CH=0
THEN Q=Q+1: IF Q=1 THEN 63530
```

This change ignores the first zero and will step to the next line address upon seeing the second zero.

With all of the above modifications a small bug could creep in to the operation. Although I did not see it happen, the machine could fail to detect line 63000 in the last phase of executing the program. To prevent the machine searching to the end of its memory, I changed the end of line 63520 to look for "LN=>63000". The program will now end where it is supposed to.

I hope this information helps other OSI users.

Larry Franklin
Brockton, MA

More on the Marathon

Editor's note: We recently received a note from Kenneth G. Anderson, Jr., of Personnelmetrics, a New York consulting firm, pointing out his company's contributions to the New York City Marathon (see "Computer Keeps Tabs on Runners", March, p. 10).

As each runner finished the race, volunteers removed a bar-coded tag attached to the runner's number. These tags were scanned with a reading wand and the data transmitted to scoring facilities provided by Personnelmetrics. Using a Data General minicomputer, Personnelmetrics quickly prepared a finishing list containing each runner's name, sex, age, country and team. The computer also notified race officials of runners qualified for any of the 125-plus awards offered by the New York Road Runners Club, who sponsored the race, and other organizations.

In addition to scoring, Personnelmetrics also created and maintained a data base of all entrants. This data base was used to produce lists, statistics, registration cards, bus passes and mailing labels.

—*D.W.*

Health Plan Remedies

Dear Editors:

There are a few corrections for my article "Your Family Health Plan" which appeared in the May issue.

All delimiters following variables "A" and "B" of the DIANAT-II flowchart on page 20 should be "less than" rather than "slash".

Keith A. Jones, Ph.D.
Jonesboro, AR

April Comments

Excellent! I like the blend of business programs and programming routines/methods.

Raymond S. Suchy
Merced, CA

Excellent article by Kirtland H. Olson. (The Incredible Time Machines.)

Bernard Savonet
France

Good article on Tax Base 1. Need more like it.

Alex De Poutiloff
Pittsburgh, PA

RANDOM ACCESS

Minnesota Educators Go Micro

Many people are realizing the tremendous potential that microcomputers have for education. MECC, the Minnesota Educational Computing Consortium, is no exeption. Recognizing the need to research the potential uses and modes of service for microcomputer users in education, MECC organized a task force with the following goals:

1. To conduct a survey for determining the current and future microcomputer needs and uses in education.
2. To determine the strengths and weaknesses of microcomputer utilization in various instructional computing modes.
3. To provide demonstrations of microcomputer use for instructional purposes.
4. To coordinate and disseminate information regarding pilot programs using microcomputers.
5. To prepare position statements regarding the potential for large-scale acquisition and utilization of microcomputers and the appropriate roles and responsibilities for MECC and its users.

Since there are so many varieties of microcomputers available, one of the first things the task force needed to do was define what components make up a minimal educational microcomputer system. All evaluations and testings from then on would only be on systems meeting these criteria. This definition also helped vendors decide what features they needed to supply in a system for educational purposes. Some of the main features of this definition are:

- Input device must be a typewriter keyboard and output a multiline monitor or a printer.
- Permanent file storage must be some form of disk.
- BASIC language must be supported.
- At least 12K user memory must be available, excluding operating system and language processor(s).

Each system was evaluated against forty-nine identified software features. By weighing these features as to importance, MECC gave each system a software features score. About forty hardware features were also looked at. Some typical features included were: K bytes of RAM, ROM and PROM; chip type; availability of real time clock; and RS-232 interface.

Since BASIC is the most often used language, the task force also evaluated the microcomputers' BASIC language features and capabilities which they deemed important. Test scripts were prepared and run on each of the systems evaluated. The scripts were divided into two categories: those that tested BASIC language features, and those which tested performance.

BASIC features scripts include: sequential file handling; random access file handling; chaining; time function; string functions; matrix operations; and formated output.

The BASIC performance scripts included: time required to complete computation (count the number of primes from 1 to 2000); number of mathematical functions available; and time required to generate and sort 100 numbers.

Once done with defining user needs, collecting data on microcomputer systems and surveying current microcomputer users, the task force made the following recommendations regarding microcomputers:

- State Contract: One specific microcomputer system should be available to all Minnesota education-related agencies through a state contract.
- Support: Instructional service support for selected microcomputers should be defined and increased to the same level as is currently available for timeshare systems.
- Microcomputer Technology: MECC should continue to analyze and evaluate microcomputer hardware and software technology, and disseminate information to the Minnesota educational community.

Through a bid process, MECC and Apple Computer, Inc., signed a contract for Apple's 32K, disk based Applesoft microcomputer system. MECC anticipates that, over a year, about 400 to 500 units will be sold to educational users in Minnesota.

A task force report printed by MECC contains the research, evaluation, recommendation and the invitation for bid for microcomputer systems. This report is currently being revised and will be available soon. For more information contact MECC, 2520 Broadway Drive, Lauderdale, MN 55113.

—Kevin Hausmann
Instructional Coordinator, MECC

Ninth Grader Develops Lighting Simulation Program

Ninth grader Brandon Rigney III of Gunn Junior High in Arlington, Texas, has developed a computer program entitled, "Designing Lighting Patterns for Efficiency Using Computer Simulation."

Using a Radio Shack TRS-80 microcomputer, Brandon, 14, wrote numerous programs and selected 20 simulated light patterns. He determined that with the computer he could simulate this aspect of an architect's scale model.

The architect's model, used to symbolize the actual building, is a means of experimenting with different ideas before final decisions are reached. A model can often exceed $10,000 in cost and is time-consuming to produce. Rigney's project showed that the computer, by planning lighting requirements, can replace this aspect of the model with a savings of time and money.

Rigney began work on his project in December and spent approximately 130 hours writing and debugging his programs, which sometimes took almost four hours to run. He also spent many hours in libraries researching architectural magazines and textbooks.

The idea for writing his program came from an experience in his classroom with flourescent lights. When his teacher arranged the desks in the center of the room to make the best of the lighting situation, Rigney wanted to see if his computer could simulate the lighting pattern of the room to show the best seating arrangement.

Rigney's program did show the exact lighting pattern of the classroom and he decided to develop the idea into a project to enter in the Arlington Science Fair, a course requirement. Dr. Leo S. Bielinski, class instructor, served as Rigney's advisor on the project.

At the Arlington Fair, which hosted approximately 200 entries in 12 categories, Rigney was awarded "Best of Fair" with his TRS-80 microcomputer project. Dr. Bielinski won the Teacher Award at the Science Fair for having the best showing of Junior High students.

Not only does Rigney use his TRS-80 to win awards, but also for a study aid. He has programmed it to conjugate French verbs, quiz him for history tests and even to aid in working out chemical equations.

Brandon began using the TRS-80 only seven months ago when his father, learning of his son's interest in microcomputers, shopped around comparing computers, decided on the TRS-80 and brought it home.

You Wear What They Compute

Apparel manufacturers used to spend long hours creating patterns for new designs. But since the advent of computer graphics, the costly and tedious process of developing and grading patterns for each garment has been replaced with a computer-based system, the Markamatic 5000.

The system, from Camsco Incorporated in Dallas, TX, also eliminates the need for marker makers to perform a series of mathematical calculations for marker making, said Ray Wheeler of Camsco. In the past, marker makers had to determine the optimum arrangement of individual patterns for the marker taking into account fabric width, stripes and plaids, as well as sewing considerations like darts and notches. Since the calculations are performed by computer, the number of errors are greatly reduced and material waste minimized, Wheeler said.

The Markamatic 5000 automates the entire process of pattern and marker making, from preliminary design through pattern alteration, grading, marker making and cut order planning. In the past, systems automated only the grading of patterns and marker making. With the Markamatic 5000, designers work at a display console and manipulate lines on a high resolution graphics screen until they conform with their basic sketches. Once they have a design they like, designers request a full-size, printed pattern from the system for a sample, or go directly to a production marker. The process insures the designer that all seams agree in length, shape and fit, Wheeler said.

illustration by Sharon Fisher

Camsco developed all system software as well as the console which consists of a Xytron CRT display and a graphics processor and video generator manufactured by Megatek Corporation in San Diego. Camsco uses a Hewlett Packard 21MX as the system processor.

Because the Markamatic offers both computer graphic and number-crunching capabilities in a fully integrated system, manufacturers are able to store data on basic design patterns such as slopers and blockers. Once they are input into the system, they can be stored permanently and retrieved when needed from a central memory. Using plain Eng-

lish commands, a designer or pattern maker calls blockers and slopers to the display screen and with a stylus makes whatever modifications are necessary so that the pattern conforms with the designer's sketch.

When the designer is satisfied with the pattern displayed on the screen, the system generates multiple-size master markers. In the past, a pattern maker had to provide a complete set of hand-drawn and cut patterns for the design. Now the marker maker has the Markamatic compute the digital definition of the required sizes and draw the graded patterns on the system's plotter. These graded patterns, Wheeler explained, are not cut but displayed on the screen so that the marker maker can arrange them into a master marker. The pattern pieces are physically positioned on the screen into a marker. After the marker is planned on the display, the Markamatic self-checks each pattern piece for conformity to marking rules. Then the plotters generate a full-size marker.

Once they have a marker, manufacturers can cost out the garment — even though the piece may still be in the prototype stage. "In a matter of minutes the Markamatic can digitize a sample pattern to produce a multiple size master marker," Wheeler pointed out. "If there are cost or design problems, alterations can be made quickly and easily by the designer and a new marker produced."

Using master markers in memory, the Markamatic 5000 evaluates all combinations of existing and planned markers, minimizing material waste and production time. Because these functions are performed automatically by the system, marker makers have more time to spend on achieveing the optimum arrangement of pattern pieces. The computer even computes and prints out the estimated cutting costs and percentage of material utilization as each marker is completed.

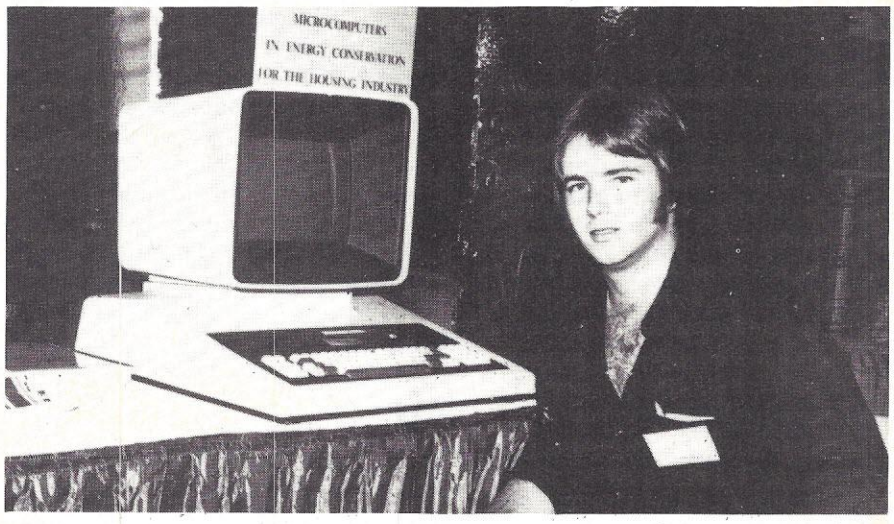
NCC Office Automation Conference

The new NCC Office Automation Conference (OAC), sponsored by AFIPS as a separate event from the National Computer Conference, will cover disciplines affecting office automation, said Floyd O. Harris, OAC Chairman. The conference is scheduled for March 3 to 5, 1980, in the Georgia World Congress Center in Atlanta.

Program sessions will deal with at least five major areas of office automation: data processing, word processing, communications, reprographics and records management, according to Harris. Meetings will be directed to top and middle management, actual users of automation equipment, technicians and inventors, manufacturers and educators. Attention will be given to cost effectiveness, incentives to automate, ways to develop automated systems, and time factors of implementation.

The NCC Office Automation Conference is sponsored by AFIPS in cooperation with four of its member societies — The Association for Computing Machinery, The Data Processing Management Association, The IEEE Computer Society and The Society for Computer Simulation. For more information contact Jerry Chiffriller, c/o AFIPS, 210 Summit Ave., Montvale, NJ 07645; (201) 391-9810.

Home Energy Saving Product Developed by 17-Year-Old



A new home energy saving product, said to reduce heat loss by as much as 25% in test homes, has been developed by a 17-year-old with the help of a Perkin-Elmer computer terminal he won at the 1978 NCC Personal Computing Show.

Nicholas Naumovich, Jr., a senior at Lake Highlands High School in Dallas, TX, won second place in the contest sponsered by the American Federation of Information Processing Societies (AFIPS) with a computer system he developed to form energy studies on home insulation efficiency. Naumovich used a Perkin-Elmer Model 1100 on loan from Perkin-Elmer and his father's Imsai 8800 microcomputer to design his winning entry. And when he won his prize, he chose a Perkin-Elmer 1100 for his award.

Naumovich took the data he received from energy audits he performed on several homes using his system to develop a new type of energy saving pro-

duct which he claims reduces heat loss by as much as 25%.

As a basis for his computer program, Naumovich used the Texas Power and Light Company's audit rating system. "When the utility company audits a house for energy efficiency to determine the billing rate, they have to determine what the heat loss and heat gain are," he explained. "To calculate this, they measure the size of each window and door, compute the number of square feet in the walls, determine the types of materials used in the walls and doors and calculate the amount of dead air space between walls. Next they perform a series of calculations which takes about three hours." According to Naumovich, these calculations take less than twenty minutes with his computer, and the audit information is more comprehensive because it includes payback periods on the cost of insulation that a homeowner can install to lower home heating and cooling costs.

Originally, Naumovich planned to market his system, but studies he ran on test homes pointed to air infiltration as the most common cause of inefficient home heating and cooling. With the help of his father, who is a contractor, Naumovich developed a new type of material to reduce air infiltration. Naumovich calls his product Thermo-Brite, an aluminized film backed by pressure sensitive adhesive that is placed on the exterior sheathing of a home. "We are using aluminized film because aluminum reflects the heat radiated into a house in warm weather, "Naumovich explained. "This helps keep cooling costs down during the summer months."

Thermo-Brite is not insulation because it is designed to cover the exterior sheathing of a house — like a giant envelope. Naumovich pointed out that because Thermo-Brite is placed on the exterior rather than the interior walls, air infiltration through electrical outlets, windows, doors and other cracks is eliminated. "When a plumber or an electrician goes through a wall to install new pipes or wiring, sheathing and insulation can be disturbed," Naumovich said. "Because Thermo-Brite seals the house from the outside, the insulation doesn't lose any of its effectiveness because of air infiltration."

Naumovich claims that he can reduce the cost of heating and cooling by as much as $800 annually by using Thermo-Brite in the construction of a house. To compute these savings he uses his computer to input data such as number and type of windows and doors as well as type and area of wall surface.

At a recent Homebuilders Convention in Las Vegas, Naumovich was a star attraction. The 17-year old overwhelmed contractors and personnel from building supply houses across the country with his computer's energy saving calculations and the potential offered by his new product. "Without the computer, my sales wouldn't be as strong," he commented. "I had my computer in the booth, with the Perkin Elmer terminal almost in the aisle so that passersby could see what I was doing."

All I wanted to do was develop something worthwhile for the NCC Personal Computing contest and make some money as well," Naumovich reflected. "I never dreamed that I'd be inventing a new type of insulation and seeking a patent."

At 17, few teenagers have the problem that Naumovich faces: college and running his own company, Parsec Incorporated, of which he's president and major stockholder. He already has more that 750 inquiries from the Homebuilders Convention to work on, not to mention some of the research and development he is already involved in.

Teaching the Teachers

As the first step toward training every pupil in the Scarsdale, NY, public schools to work with computers, Teachers College/Columbia University has begun educating all 300 Scarsdale teachers in the new technology.

The project, initiated by the Scarsdale Board of Education, will introduce computers into the curriculum, kindergarten through grade 12, with the assistance of the Teachers College Program in Computing and Education. Ten microcomputers have already been purchased and installed, and 100 teachers began studying in January with the program's director, Robert Taylor, adjunct assistant professor of education at Teachers College.

"We're trying to integrate computing into the educational program as a tool, a tutor and a device to be tutored," Taylor said, predicting that most Scarsdale teachers will have completed some introductory training in computing within the year. The teachers, in turn, will train their students as computers are installed, at least one in every school by September, and one in every classroom within five years.

Possible uses of the computer as a tool, Taylor suggested, include storage of statistical data and editing of manuscripts — student papers as well as instructional materials prepared by teachers.

Taylor described the in-service training of teachers as an important aspect of the program in that no new teachers will have to be hired for implementation. Moreover, Scarsdale faculty members who may be studying toward a graduate degree at Teachers College, can receive credit for the computer course.

Scarsdale teachers, parents and community members participate in planning the computer project.

Volleyball Game Nets Computer

Members of two honors chemistry classes at Triton Regional High School in Runnemede, NJ, recently staged a 10-hour-long volleyball game to raise money needed for a Radio Shack TRS-80 computer.

The students' decision to get a computer for their classroom came after chemistry instructor Dennis Di Marco explained the computer's capabilities for quickly processing experiment results and providing answers, allowing students to check their work.

The students decided that a marathon volleyball tourney might generate enough interest (and money) to make their dream of a classroom computer a reality. A goal of $600 was established, to be met through pledges from other students, parents and local businesses.

At the end of the volleyball match, the students and instructor Di Marco were delighted that their original goal had not only been met, but exceeded. Over $1200 in cash and pledges had been collected during the event.

The students had some help, though. A local restaurant supplied drinks for the thirsty volleyballers and a nearby Radio Shack store set up several TRS-80 microcomputers programmed for games. A twenty-five cent donation permitted spectators to try their luck at beating the computer.

After their successful fundraiser, instructor Di Marco and students decided to purchase the Level-I model of the Radio Shack microcomputer and a printer for a permanent record of computer work. According to Di Marco, "the remaining money will probably go for additional instruction manuals which students can take home with them."

Shortly after the computer arrived at the school, students began staying after class to learn to program it. Other students have also expressed interest in summer jobs in the computer field.

Up, Up and Away: Forecast and Analysis of the Personal Computing Market

Vantage Research has released a new forecast and analysis of the personal computing market which shows rapid growth, a flood of new products and a major industry restructuring. The forecast is in a recent issue of *Personal Computing Industry Report,* a monthly market analysis, reporting and forecasting service published by Vantage Research.

The report indicates that rapid growth of the market over the next five years will be accomplished by a big shake-out of existing suppliers and a restructuring of the market as the large suppliers enter the market. Retail sales will be an important part of the market growth.

In 1978 there were 215,000 personal computers sold with a market value of $500 million, according to the report. The estimates for 1979 show sales increasing to 425,000 units with a value of $825 million. Sales are to users in business, professional, education, recreational and home applications. An estimated 48% of the 1978 sales were through retail outlets.

The forecast indicates sales of 2.2 million units in 1982 with a market value of $2.4 billion.

The entry of the large, vertically integrated suppliers such as Tandy, Texas Instruments, Digital Equipment Corp., Atari and IBM is expected to bring about a major restructuring of the distribution and support of personal computing products and services. A shake-out of hardware manufacturers and independent retail stores has already started and is expected to accelerate into 1980.

For further information contact Vantage Research, Inc., 2690 East Bayshore Road, Mountain View, CA 94043;

Self-Merchandising Software Units

ComputerLand Corporation is introducing two new, self-merchandising fixtures for their stores, SoftSpot and MainBrain. In the past few years, many personal computers have been available, but not much software to use with them, believes Computerland. SoftSpot is a custom-designed, self-merchandising fixture offering off-the-shelf programs for personal use in finance, time budgeting, education, entertainment, stock analysis and stock portfolio evaluation. The fixture will assist ComputerLand customers in selecting the software they want, starting at $7.95, from suppliers like Apple Computer, Personal Software, Program Design, Commodore, Powersoft, Softape and GRT.

Customer education about personal computers and their applications will be offered through MainBrain, a unit for educational media. Books, self-study cassette and video tape courses and "in-person" lecture programs will be available from publishers such as Sybex, Osborne & Associates and Hayden. MainBrain will have self-service instructions to assist customers in making their own choices of desired multimedia educational products.

Northeast Computer Show

The Northeast Computer Show will be held in Boston on Friday, Saturday and Sunday, September 28 to 30.

Billed by the producers as the largest show of hardware and software assembled in Boston, it will be three shows in one. In addition to a trade show for computer industries, a small business systems show and a personal computing show are scheduled.

The Northeast Small Business Computer Show will display systems for business use by bankers, lawyers, hospital administrators, doctors, dentists, accountants and others. Word processing, data processing and other applications are included.

Exhibits at the Northeast Personal Computing Show will be directed at engineers, hobbyists, homeowners, technicians, gadgeteers, business people, professionals, students and educators.

Added attractions include free seminars and lectures, demonstrations, and prizes awarded in various computerized contests. Special exhibits for children will feature calculators, computers and educational systems.

The show, located in Hynes Auditorium at the Prudential Center in Boston, will cost $5 for admission. Times of the show are 5:00 to 10:00 p.m. Friday, noon to 10:00 p.m. Saturday and noon to 6:00 p.m. Sunday.

Uncle Sam Wants You

The Department of Defense Dependents Schools need computer science and electronics teachers. These DOD schools, which serve children of US military and civilian support personnel around the world, have 38 computer systems available for instructional use, with BASIC the most common language.

Applicants should have a minimum of nine semester hours in computer science plus sufficient additional course work to qualify to teach in another subject.

For more information, call Mr. Francisco or Ms. Wycoff at (202) 325-0690. For employment applications, write Department of Defense, Office of Dependents Schools, 2461 Eisenhower Avenue, Alexandria, VA 22331.

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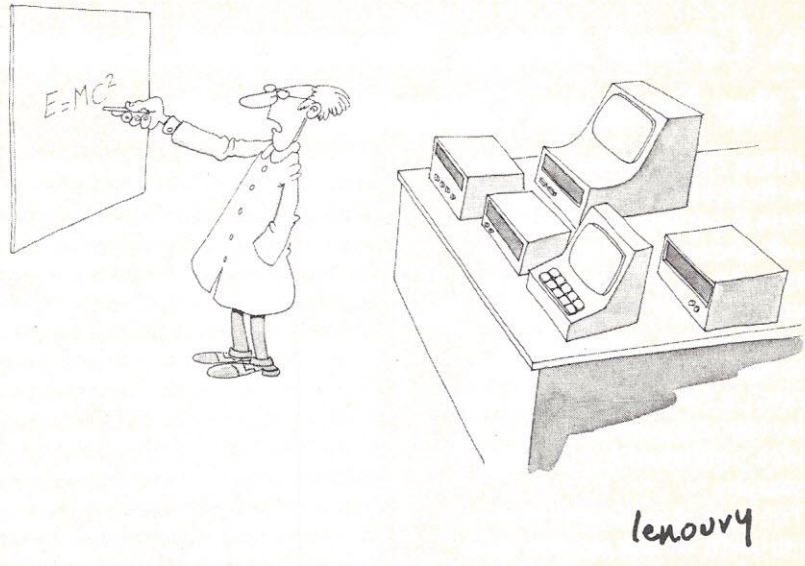
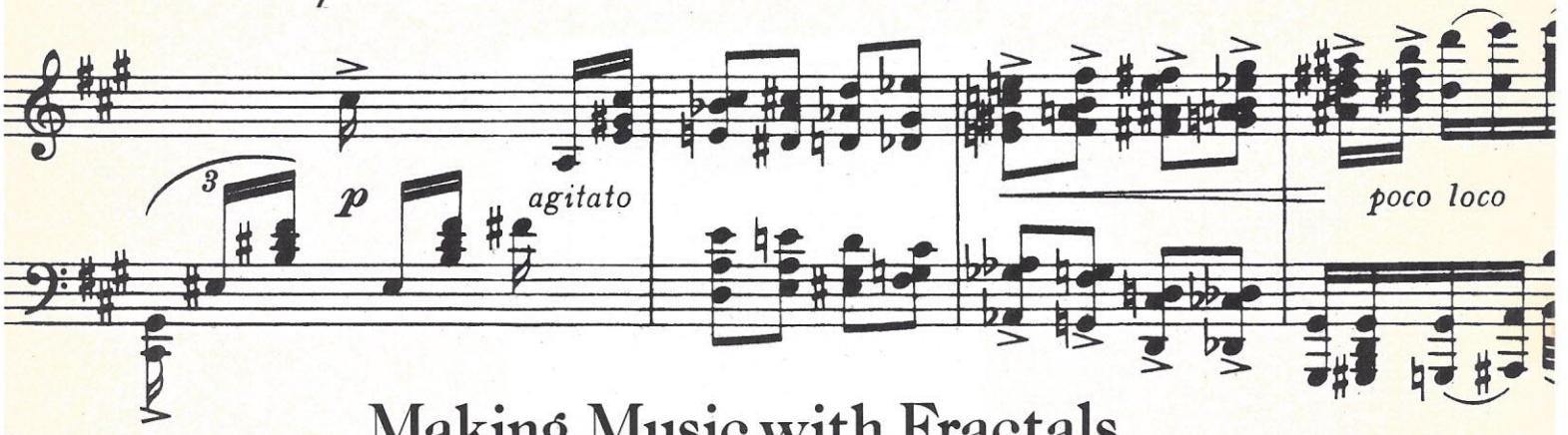


1/f Random Tones



Making Music with Fractals

BY ANTHONY T. SCARPELLI

Fine arts have for a long time been duplicating nature, or at least trying to imitate her as much as possible. Yet, music seems to be the least imitative of those arts. So how can it be connected to nature's seemingly structured randomness? Well, a certain statistical property of the world appears to be the connection. This property was discovered by Richard F. Voss, an IBM physicist. His discovery concerns the relation or "autocorrelation" between vibrations and their power spectrum.

To understand this concept we have to consider types of random sounds. For instance, changing the speed at which you play music on your phonograph naturally decreases or increases the sound's pitch. However, a type of sound called "scaling noise" sounds the same no matter what speed you play it at. An example is white noise, like the random noise produced in a resistor, or even plain static. One bit of noise is completely unrelated to the last bit or any future bit. Its autocorrelation factor is zero. You can write a program to generate such random notes, but it soon becomes boring.

A more correlated noise, called Brownian noise, is also random, but each bit of noise is related to the last bit and to the next bit. To get a picture of this type of noise, imagine a butterfly flying. Its path is apparently random, yet it is a connected, though wandering flight. Although music made from Brownian noise has a high autocorrelation factor, it still tends to be dull.

Half-way between white and brownian noise is Voss's discovery, or 1/f noise. If white noise is $1/f^0$, and brown noise is $1/f^2$, half-way is naturally 1/f, or pretty close to it. To base music on this type of noise is a lot more fun and interesting.

But before I get to that, I should explain the term "fractals". Benoit B. Mandelbrot coined this term to cover a class of patterns having the property that no matter how closely you look at them, they always look the same. He discovered that the flooding of the Nile, variations in sunspots and undersea currents, are based on 1/f fluctuations. Voss says our total experience is based on 1/f noise.

An article by Martin Gardner in *Scientific American* (April 1978) contains an example showing how to produce 1/f numbers using dice. I took that example and programmed my KIM-I to do it repeatedly and to play notes and tunes based on the 1/f numbers. Here's how it works:

We get three dice, or program our computer to get them. We also make three columns of binary numbers, each column representing one of the dice. Since there are three dice, we need to count in binary up to 2^3, or eight. See Figure 1.

At first all three dice are thrown, represented by the first row of zeros. A 3 is stored in a memory location to start the pattern that indicates which dice will be thrown. The three dice, actually generated random numbers, are added up; this sum points to a note on a piano,

	COLUMN			
ROW	3	2	1	
0	0	0	0	3
1	0	0	1	1
2	0	1	0	2
3	0	1	1	1
4	1	0	0	3
5	1	0	1	1
6	1	1	0	2
7	1	1	1	1

Figure 1 Figure 2

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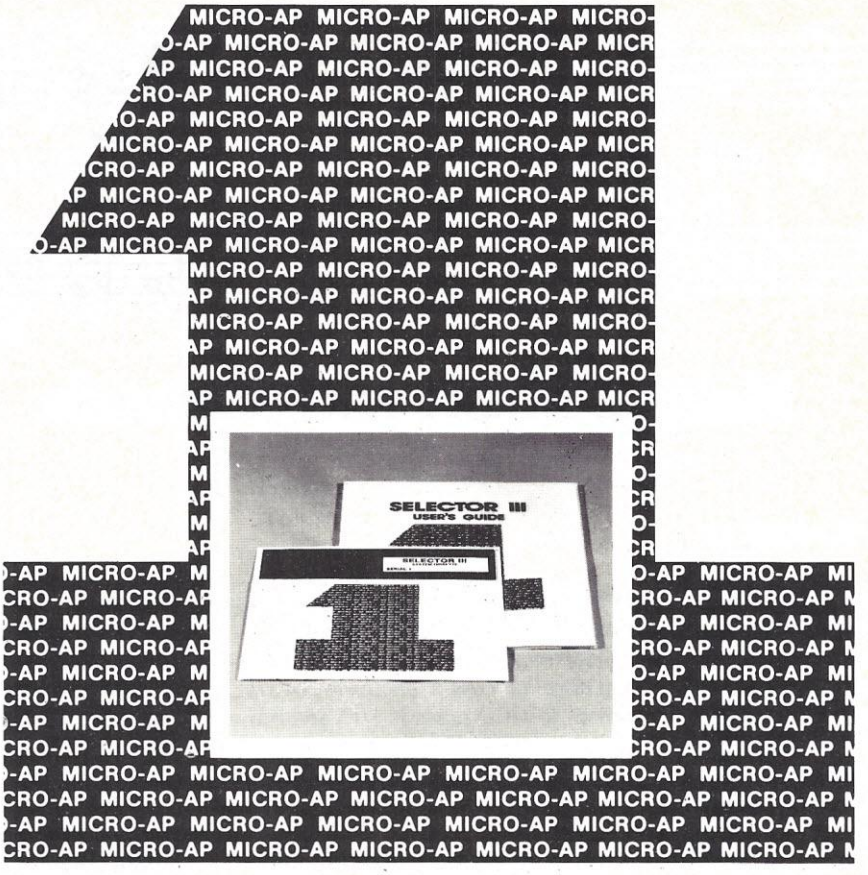

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- **1 p.m.** Introduction to Small Business Users
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- **3 p.m.** Unassigned at press time
- **3 p.m.** How to Write a User-Oriented Program
- **4 p.m.** Efficient Expansion of a Small System
- **4 p.m.** Investment Analysis
- **5 p.m.** Accounts Receivable/General Ledger/Accounts Payable
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Saturday, August 25

- **11 a.m.** Introduction to Personal Computing
- **11 a.m.** Unassigned at press time
- **12 p.m.** Computer Music Update
- **12 p.m.** Unassigned at press time
- **1 p.m.** Introduction to PASCAL
- **1 p.m.** Computer Art Forms
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or in our case, to a note in memory. In going from zero to one, only the first column changes, so only the die representing that column is thrown. All three dice are added and we point to another note. From row 1 to 2, both columns one and two change, so those two dice are thrown and again all three are added.

This process continues and we have a pattern for the eight rows, Figure 2, which show what dice are thrown. After row seven the whole thing repeats. The numbers generated are random, yet, as you can see, the dice in column three changes occasionally, in column two more so, and all the time in column one. Thus, we have 1/f random numbers, because the numbers aren't completely random: the last column keeps the total count within a band of numbers, and yet it is more than very closely correlated due to the always changing ones column.

Let's go to the program to see how it does this. In location 0201 we seed our random number generator with a number from the internal timer. This method is more insurance for randomness. So, every time we start we get a new seed number.

The number at 020A represents 100 notes. After that number the program will start at the beginning again. So here you can make each tune as long as you want.

The location 020E shows us how many rows there are. This points to the pattern of Figure 2, in memory, which shows us which and how many dice are thrown. So at 0212 to 0220 we test to determine what column is to be randomized. Then, from 0222 to 0233, we go to the random number subroutine to get either one, two or three numbers. Each number will be from 0 to 5; so we can get a total of 0 to 15, or up to 16 notes. We add them together from 0235 to 023A and store the result, which points to the note we want.

In music, not only do you have a note with a certain frequency, or pitch, but you have a certain note length. I decided I might as well 1/f randomize the length too, so from 023C to 0265 we have a similar procedure as with the notes. But, we have only two dice to contend with, and we have them add up from 0 to 6 to give us seven possible lengths — basically from an eighth note to a little over a whole note. We'll go into this again later on. Locations 0267 to 026C will point to the length and fetch it for our tone subroutine. The rest of this section of the program will either get a next note, start the column pattern again or start the program over, and also play the note.

Add	Data	Notes	Data	Notes	Data	Notes	Data	Notes	Data	Notes
0008	01	0	01	0	01	0	01	0	01	0
09	01	0	01	0	01	0	01	0	01	0
0A	01	0	A6	D	01	0	BB	C	01	0
0B	B0	C#	C6	B	BB	C	BB	C	BB	C
0C	B0	C#	93	E	B0	C#	A6	D	BB	C
0D	9C	D#	BB	C	93	E	A6	D	7B	G
0E	9C	D#	BB	C	8A	F	93	E	7B	G
0F	83	F#	93	E	8A	F	93	E	5B	C
10	83	F#	8A	F	7B	G	83	F#	5B	C
11	74	G#	A6	C	7B	G	83	F#	51	D
12	74	G#	7B	G	74	G#	74	G#	51	D
13	67	A#	7B	G	61	B	74	G#	48	E
14	67	A#	DF	A	5B	C	67	A#	48	E
15	01	0	01	0	01	0	67	A#	01	0
16	01	0	01	0	01	0	01	0	01	0
17	01	0	01	0	01	0	01	0	01	0
	(A)		(B)		(C)		(D)		(E)	

Figure 3

The random subroutine is taken from the *First Book of KIM*. If a person has a KIM-I, this book is a great way to start out with all kinds of games and other useful programs. Any random number generator can be used here. We had to get the number divided down so that our number will be from 0 to 5, but that's simple enough. I don't think we need numbers too random here since 1/f numbers are correlated. Yet, playing with randomness here will produce other interesting effects.

I have two tone-generator subroutines. One will just produce a note. It uses an output port and the speaker arrangement as shown in the KIM-I user's manual. Locations 028C and 028E open the port; 0291 and 0293 start the KIM internal timer; 0296 to 029B get the note from the table at 0008. It's a number which delays the program a certain length of the time, so after it runs out, it toggles the output port at 029D. From 02A0 to 02A7 we test the timer, which gives us our basic time delay; when it runs out we'll decrease the length number by one and start over again. When the note has played out we just get another.

Here I'll go into the notes and time. The note table is from 0008 to 0017.

FB	G	9C	D#	61	B	3B	G
ED	G#	93	E	5B	C	38	G#
DF	A	8A	F	56	C#	34	A
D2	A#	83	F#	51	D	31	A#
C6	B	7B	G	4C	D#	2E	B
BB	C	74	G#	48	E	2B	C
B0	C#	6D	A	43	F	01	rest
A6	D	67	A#	3F	F#		

Figure 4 **Notes with data values.**

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CIRCLE 9

With this program the highest frequency is 17,863 Hz, which is inaudible, so I made that note a rest, indicated in the note table as #01. The rest of the notes I set with a frequency counter. To do this I had to stay in the tone loop. If you want to set up your own frequencies, start the program as normal, then stop it and change 02A5 to 10 instead of 30. Start it again, but don't go back to the beginning; just hit PC and then GO. Otherwise it sounds like a lot of jibberish; interesting, but hard to sync a fequency counter on. The eleven notes you see are the notes in the key of C major. My wife, a professional musician, suggested this range and some others, listed in Figure 3. There are five no-notes or rests. According to my wife, rests are just as important as sound. This arrangement works well, and since the primary notes cluster more around the center anyway, the rests at each extreme are not overpowering. Here is where experimentation really comes in. With the right choice of notes and/or rests, a wide variety of tunes is possible.

We had a lot of fun trying different notes and arrangements. There are many types of scales in music. Western and Eastern music are somewhat different, but occasionally the scales will be very similar. The pentatonic scale, Figure 3A, sounds very oriental. The other scales shown in Figure 3 are also interesting. For instance, B sounds folksy, C is like an Indian raga, D is like Debussy (well, almost), and E contains the notes from the music communication sequence of the movie *Close Encounters of the Third Kind*. The most fascinating thing about trying different scales and note arrangements is that you can detect different music qualities. There is plenty of room for experimentation.

Playing with the note lengths is also intriguing. I found that changing around and varying the times in the length table at 001A to 0020 changes the whole effect of the tune. The sequence I ended up with is based on the "law of octaves".

After listening to the 1/f tunes for a while, I began to wonder what notes were being played (I don't have a good pitch ear). Consequently, I came up with the second tone subroutine, VUNOTE. It displays each note on the KIM as it is being sounded. Since the display can be programmed to do various tricks, it wasn't too difficult to add in the necessary steps to accomplish this. However, the added steps changed the timing of the note frequency loop, so I had to dispense with the rests. We must also change to a new note table, and add a note letter table and a sharp table. Each note has its own distinguishable letter, and the sharps have become an "H"; but the message is clear.

I would suggest reading the *Scientific American* artricle if you'd like to get more involved in this fascinating area. I'm sure there is much more here than meets the ear. If 1/f randomness is really a fundamental concept, it could help us understand this universe we live in, and maybe even let us listen to the music of the spheres. □

For more information

Scientific American, April 1978, Vol. 238, No. 4

Fractals: Form, Chance, and Dimension, Benoit B. Mandelbrot, W.H. Freeman and Co., San Francisco, CA 1977.

The First Book of KIM, Jim Butterfield, Stan Ockers, Eric Rehnke, Hayden Book Co., Rochelle Park, NJ.

Programming a Microcomputer: 6502, Caston C. Foster, Addison Wesley Publishing Co., Menlo Park, CA.

Figure 5

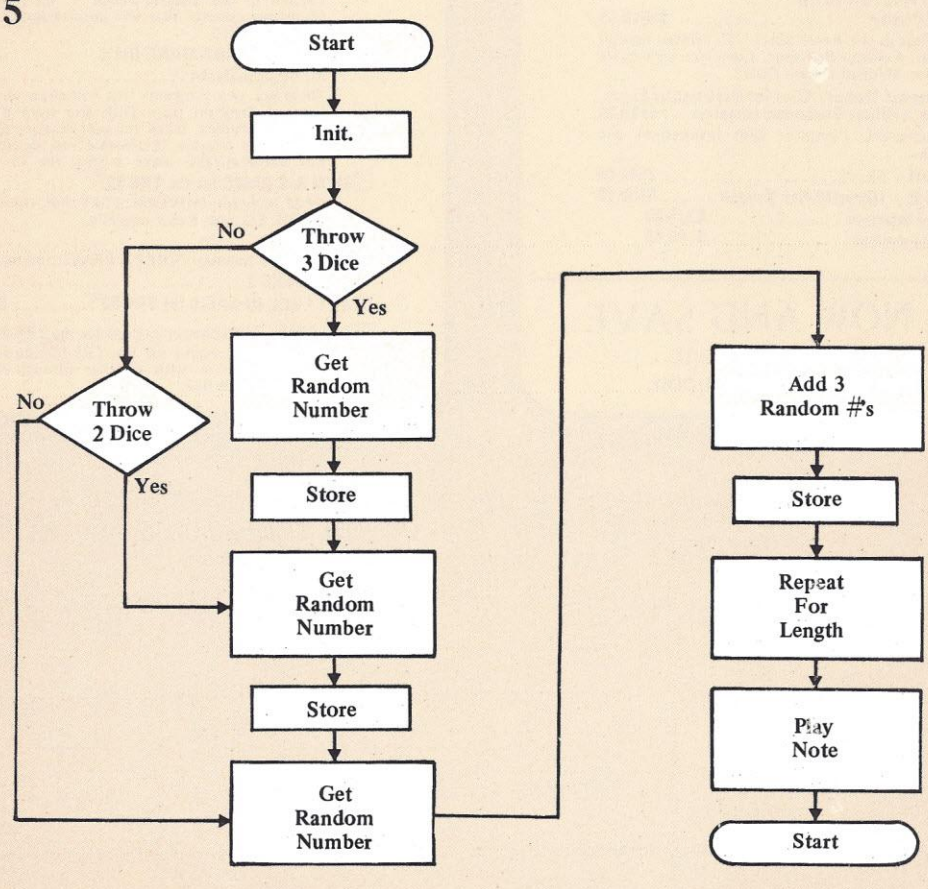
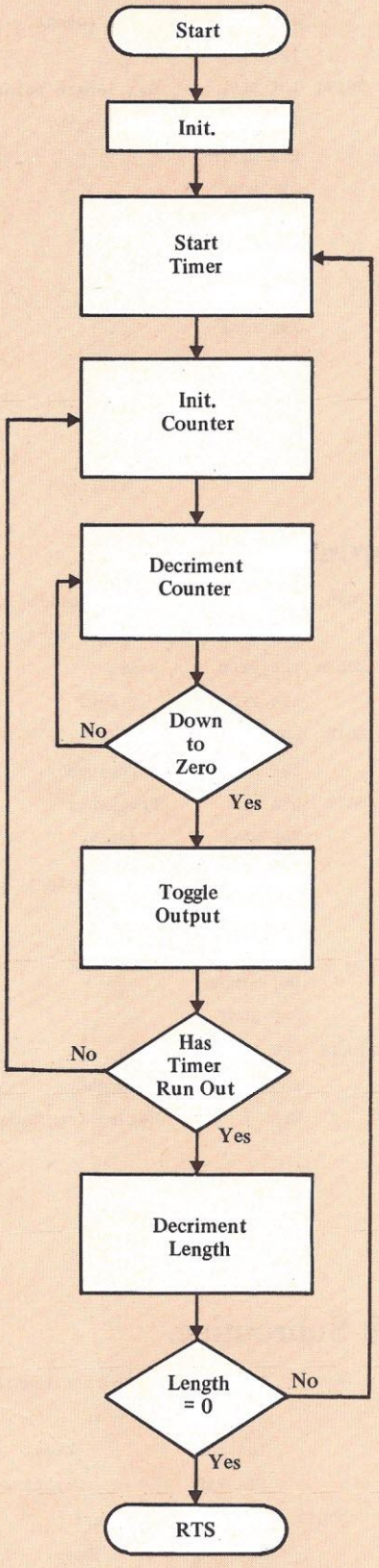


Figure 6



Memory locations in page zero.

```
COL    0000  01        TIME   001A  04
         01  02                 1B  08
         02  01                 1C  0C
         03  03                 1D  13
         04  01                 1E  17
         05  02                 1F  1B
         06  01                 20  1F
         07  03
NOTE   0008  01             0041  ROW
         09  01               42  MEMTWO
         0A  A6               43  MEMTRE
         0B  C6               44  SUM
         0C  93               45  SUML
         0D  BB               46  LENTH
         0E  BB               47  RND
         0F  93               48  RND+1
         10  8A               49  RND+2
         11  A6               4A  RND+3
         12  7B               4B  RND+4
         13  7B               4C  RND+5
         14  DF               4D  RAND
         15  01               4E  MEMFOR
         16  01               4F  LCOL
         17  01               50  TUNE
DIVR   0018  C0
```

Memory locations in page zero for VUNOTE subroutine.

```
NOTE   0008  9B  D#    VSNOTE 0021  DE    VSHARP 0031  F6
         09  92  E                 22  F9              32  00
         0A  8A  F                 23  F1              33  00
         0B  82  F#                24  F1              34  F6
         0C  7A  G                 25  BD              35  00
         0D  6C  A                 26  F7              36  00
         0E  60  B                 27  FC              37  00
         0F  5A  C                 28  B9              38  00
         10  50  D                 29  DE              39  00
         11  4B  D#                2A  DE              3A  F6
         12  47  E                 2B  F9              3B  00
         13  42  F                 2C  F1              3C  00
         14  3E  F#                2D  F1              3D  F6
         15  3A  G                 2E  BD              3E  00
         16  33  A                 2F  F7              3F  00
         17  2E  B                 30  FC              40  00
```

1/f Random Tones Main Program.

```
0200  D8        START  CLD           Initializations.
  01  AD 04 17        LDA TIMER     Get random number.
  04  85 48           STA RND+1
  06  A9 01           LDA #01
  08  85 4F           STA LCOL
  0A  A9 64           LDA #$64      Tune length.
  0C  85 50           STA TUNE
  0E  A9 07     RPT   LDA #07       Number of rows.
  10  85 41           STA ROW
  12  A6 41     NEXT  LDX ROW       Tests
  14  B5 00           LDA COL,X       which
  16  C9 03           CMP #03           column
  18  F0 08           BEQ THREE           is
  1A  C9 02           CMP #02               to
  1C  F0 0B           BEQ TWO                 be
  1E  C9 01           CMP #01                   randomized.
  20  F0 0E           BEQ ONE
  22  20 D2 02 THREE  JSR RANDOM    Get random number.
  25  A5 4D           LDA RAND
  27  85 43           STA MEMTRE
  29  20 D2 02 TWO    JSR RANDOM    Get random number.
  2C  A5 4D           LDA RAND
  2E  85 42           STA MEMTWO
  30  20 D2 02 ONE    JSR RANDOM    Get random number.
0233  A5 4D           LDA RAND
  35  18              CLC
  36  65 42           ADC MEMTWO    Add
  38  65 43           ADC MEMTRE      all
  3A  85 44           STA SUM           columns.
  3C  A5 4F           LDA LCOL      Tests which
  3E  C9 01           CMP #01         length column
  40  F0 04           BEQ LTWO          is to
  42  C9 00           CMP #00             be
  44  F0 09           BEQ LONE              randomized.
  46  20 D2 02 LTWO   JSR RANDOM    Get random number.
  49  85 4D           LDA RAND
  4B  29 03           AND #03       Reduce to correct range.
  4D  85 4E           STA MEMFOR
  4F  20 D2 02 LONE   JSR RANDOM    Get random number.
  52  C6 4F           DEC LCOL
  54  A5 4D           LDA RAND
  56  29 03           AND #03       Reduce to correct range.
  58  18              CLC
  59  65 4E           ADC MEMFOR    Add length columns.
  5B  85 45           STA SUML
  5D  A5 4F           LDA LCOL      Test to get
  5F  C9 00           CMP #00         LCOL
  61  F0 04           BEQ NOINC         back to
0263  E6 4F                 INC LCOL          normal.
  65  E6 4F                 INC LCOL
  67  A4 45     NOINC LDY SUML      Get length pointer.
  69  B9 1A 00        LDA TIME,Y    Get length.
  6C  85 46           STA LENTH
  6E  C6 41           DEC ROW
  70  30 9C           BMI RPT
  72  C6 50           DEC TUNE
  74  30 8A           BMI START
  76  20 8C 02        JSR TONE
  79  4C 12 02        JMP NEXT
```

Tone Subroutine.

```
028C  A9 01     TONE  LDA #01       Initialization  of
  8E  8D 01 17        STA PADD        output port.
  91  A9 20     SOUND LDA #$20      Start
  93  8D 0F 17        STA 170F        timer.
  96  A4 44     NOTE  LDY SUM       Note
  98  B6 08           LDX NOTES,Y     frequency.
  9A  CA        WAIT  DEX           Frequency
  9B  D0 FD           BNE WAIT        delay.
  9D  EE 00 17        INC PAD       Toggle output.
  A0  A9 80           LDA #$80      Test
  A2  2C 07 17        BIT 1707        counter.
  A5  30 03           BMI TIMOUT
  A7  4C 96 02        JMP NOTE
  AA  C6 46   TIMOUT  DEC LENTH     Note
  AC  D0 E3           BNE SOUND       length.
  AE  60              RTS           Return from Subroutine.
```

VUNOTE Subroutine.

```
028C  A9 7F     TONE  LDA #7F       Initialization
  8E  8D 41 17        STA 1741        of
  91  A9 01           LDA #01           output
  93  8D 01 17        STA PADD            ports.
  96  A9 20     SOUND LDA #$20      Start
  98  8D 0F 17        STA 170F        timer.
  9B  A4 44     NOTE  LDY SUM       Note
  9D  B6 08           LDX NOTES,Y     frequency.
```

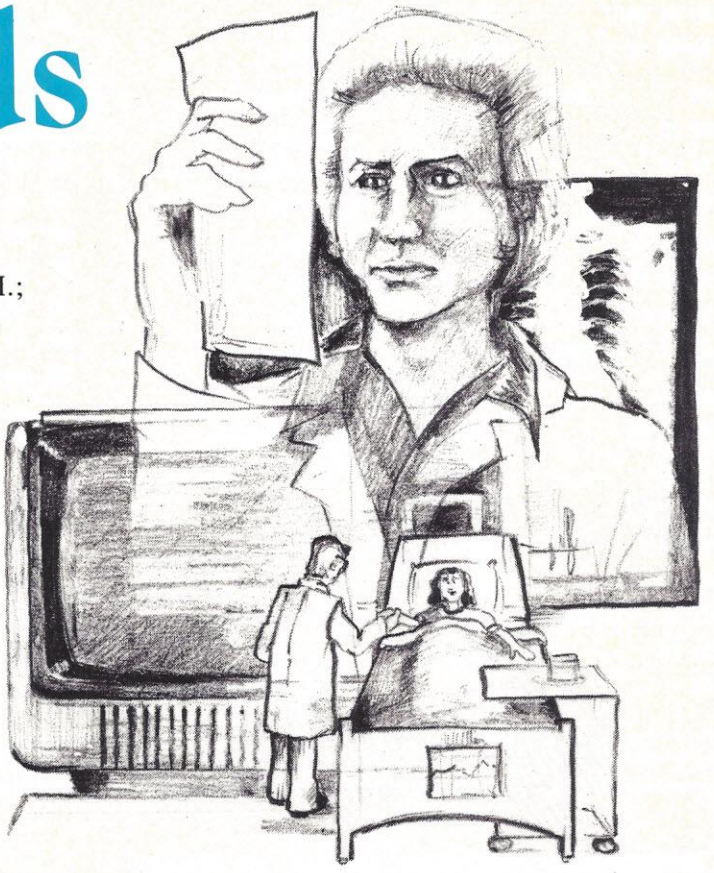
Random Subroutine.

```
9F  A9 0D          LDA #$0D     Open 3rd
A1  8D 42 17       STA SBD        digit.
A4  B9 21 00       LDA VSNOTE,Y Display
A7  8D 40 17       STA SAD        note.

AA  CA       WAIT  DEX          Frequency
AB  D0 FD          BNE WAIT       delay.
AD  B6 08          LDX NOTES,Y  Get sharp pointer.
AF  A9 0F          LDA #$0F     Open 4th

B1  8D 42 17       STA SBD        digit.
B4  B9 31 00       LDA VSHARP,Y Display
B7  8D 40 17       STA SAD        sharp.
BA  CA       WAIT  DEX          Frequency

BB  D0 FD          BNE WAIT       delay.
BD  EE 00 17       INC PAD      Toggle output.
02C0 A9 80         LDA #$80     Test
C2  2C 07 17       BIT 1707       timer.

C5  30 03          BMI TIMOUT
C7  4C 9B 02       JMP NOTE
CA  C6 46    TIMOUT DEC LENTH   Note length.
CC  D0 C8          BNE SOUND
CE  60             RTS          Return from subroutine.
```

```
02D2 D8 38   RANDOM CLD SEC      Clear decimal, add one.
D4  A5 48           LDA RND+1    Adds
D6  65 4B           ADC RND+4      random
D8  65 4C           ADC RND+5        numbers.
DA  85 47           STA RND      New random number.
DC  A2 04           LDX #04      Move 5
DE  B5 47    RPL    LDA RND,X      numbers.
E0  95 48           STA RND+1,X
E2  CA              DEX
E3  10 F9           BPL RPL
E5  A9 C0           LDA #$C0     Reduce
E7  85 18           STA DIVR       random
E9  A5 47           LDA RND          number
EB  A2 05           LDX #05            to
ED  C5 18    RNDLP  CMP DIVR             correct
EF  90 02           BCC SHIFT             value.
F1  E5 18           SBC DIVR
F3  46 18    SHIFT  LSR DIVR
F5  CA              DEX
F6  10 F5           BPL RNDLP
F8  85 4D           STA RAND
FA  60              RTS          Return from subroutine.
```

Filing Medical Records

BY WILLIAM S. WALKER, D.V.M.;
AND MEDICOMP SYSTEMS, INC.



Health professionals must deal with thousands of patient records. Manual comparisons or inspection of certain sub-groups within these files is very difficult. Each patient's complete record, often ten pages or more in length, must be read.

With a patient data base implemented on a microcomputer, a doctor can quickly generate a list of patient names. Using a system of this type allows the doctor, dentist or veterinarian to review success/failure rates of a specific type of surgical repair. This sort of retrospective study, very important to good medical care, is not easily available to practitioners without computer help.

The consultants of Medicomp and I developed a Surgical Procedure Retrieval System which allows the doctor to create a patient data base and search it by the patient's name, date of surgery or type or surgical procedure performed.

Recently, physicians found that radiation therapy used to treat certain thyroid diseases in the 1950s actually caused thyroid tumors to occur! Hospitals throughout the United States searched their files for patients who had received this treatment, to advise them to get a complete check-up. Had a Surgical Procedure Retrieval System been in operation, this medically vital search would have gone much more quickly — and would have been more accurate as well.

Similarly, a certain type of intrauterine device (IUD) causing uterine perforation, and high doses of Diethylstilbesterol, which produce uterine tumors, have also caused widespread file searching — involving several *million* patients!

Our Surgical Procedure Retrieval System was written for a Level II, TRS-80 with 16K memory and a single cassette recorder. Any BASIC with string handling capabilities would work equally well.

In keeping with the principles of structured programming, each well-defined function within the program has been placed into a sub-routine. An organizational block diagram (Figure 1) shows the main function of each subroutine as well as the input and output data needed for each module. All variables are listed at the start of the program, and all subroutines are separated by REMark statements.

As written, this program will hold one hundred names in main memory. It can also write onto and read from a cassette all names currently held in memory. For larger lists, a mass storage device such as a floppy disk can store the data, and the program can be modified to read from and write to the disk.

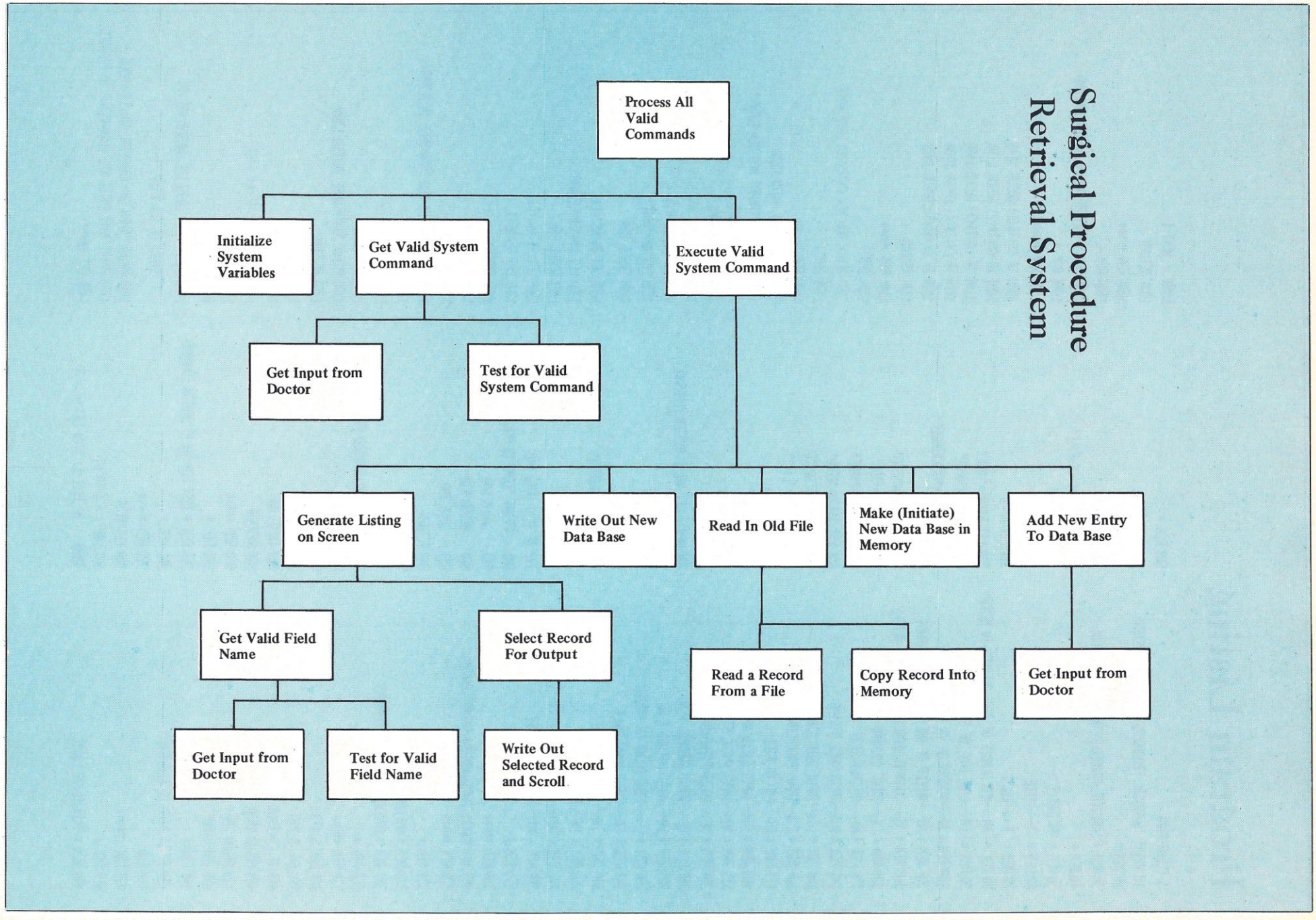
For ease of operation, I suggest that doctors prepare "dictionaries" which list their surgical procedures in a condensed or abbreviated manner. This dictionary will prevent inputing similar terms (appendectomy, removal of appendix) which could not be retrieved easily due to the character string handling within the program. □

System Commands

STOP. . . .	Stop program execution
ADD. . . .	Add a new member to data base
LIST. . . .	List members in data base according to a field name
READ. . .	Read a file from cassette
WRITE. . .	Write data base to file on cassette
MAKE. . .	Make new data base in memory

Field Names

NAME.	Name of patient
DATE.	Date of surgery
PROCEDURE.	Type of procedure


Surgical Procedure Retrieval System
Process All Valid Commands
Initialize System Variables
Get Valid System Command
Execute Valid System Command
Get Input from Doctor
Test for Valid System Command
Generate Listing on Screen
Write Out New Data Base
Read In Old File
Make (Initiate) New Data Base in Memory
Add New Entry To Data Base
Get Valid Field Name
Select Record For Output
Read a Record From a File
Copy Record Into Memory
Get Input from Doctor
Get Input from Doctor
Test for Valid Field Name
Write Out Selected Record and Scroll

Program Listing

```
5 CLEAR 9000
10 PRINT "SURGICAL PROCEDURE RETRIEVAL SYSTEM"
20 REM *
30 REM * SURGICAL PROCEDURE RETRIEVAL SYSTEM
40 REM *
50 REM * VARIABLES :
60 REM *  T----TRUE
70 REM *  F----FALSE
80 REM *  NM---MAX NUMBER OF RECS ALLOWED IN MEMORY
90 REM *  LM---LINE MAX  OF SCREEN
100 REM * NF---NUMBER OF VALID FIELD NAMES
105 REM * NT---NUMBER OF VALID SYSTEM COMMANDS
110 REM * NS---CURRENT NUMBERS OF RECS IN MEMORY
120 REM * C$---INPUT COMMAND STRING
130 REM * M$---MESSAGE TEXT
140 REM * NI$--INPUT NAME STRING
150 REM * DI$--INPUT DATE STRING
160 REM * PI$--INPUT PROCEDURE STRING
170 REM * E$---END OF FILE
180 REM * FI$--INPUT FIELD NAME STRING
190 REM * VI$--INPUT VALUE STRING
200 REM * VF---VALID FIELD NAME FLAG
210 REM * VC---VALID COMMAND FLAG
220 REM * VR---VALID RECORD FLAG
230 REM * L----LINE COUNT ON SCREEN
240 REM * F$---FIELD NAME TABLE
250 REM * T$---COMMAND TABLE
260 REM * N$---NAME TABLE
270 REM * D$---DATE TABLE
280 REM * P$---PROCEDURE TABLE
290 REM *
300 REM *****
310 DIM F$(2),T$(5),N$(99),D$(99),P$(99)
320 REM *****
330 REM *
340 REM * OVERALL PROCEDURE
350 REM * PROCESS ALL VALID COMMANDS
360 REM *
370 REM *****
380 GOSUB 470
390 GOSUB 700
400 IF C$=T$(0) GOTO 440
410 GOSUB 1030
420 GOSUB 700
430 GOTO 400
440 PRINT
450 PRINT "END OF SESSION."
460 END
470 REM *****
480 REM *
490 REM * INITIALIZE LOGIC
500 REM *
510 REM *****
520 LET T=1
530 LET F=0
540 LET E$="END-OF-FILE"
550 LET NM=100
560 LET LM=10
570 LET NF=3
580 LET F$(0)="NAME"
590 LET F$(1)="DATE"
600 LET F$(2)="PROCEDURE"
610 LET NT=6
620 LET T$(0)="STOP"
630 LET T$(1)="ADD"
640 LET T$(2)="MAKE"
650 LET T$(3)="READ"
660 LET T$(4)="WRITE"
670 LET T$(5)="LIST"
680 GOSUB 1330
690 RETURN
700 REM *****
710 REM *
720 REM * GET VALID SYSTEM COMMAND
730 REM *
740 REM *****
750 PRINT
760 LET M$="COMMAND"
770 GOSUB 850
780 GOSUB 930
790 IF VC=T GOTO 840
800    PRINT "INVALID COMMAND"
810    GOSUB 850
820    GOSUB 930
830    GOTO 790
840 RETURN
850 REM ******
860 REM *
870 REM * GET A COMMAND FROM USER
880 REM *
890 REM *****
900 PRINT M$;
910 INPUT C$
920 RETURN
930 REM *****
940 REM *
950 REM * TEST FOR VALID SYSTEM COMMAND
960 REM *
970 REM *****
980 LET VC=F
990 FOR I = 1 TO NT
1000    IF T$(I-1) = C$ LET VC = T
1010    NEXT I
1020 RETURN
1030 REM *****
1040 REM *
1050 REM * EXECUTE VALID SYSTEM COMMAND
1060 REM *
1070 REM *****
1080 IF C$=T$(1) GOSUB 1140
1090 IF C$=T$(2) GOSUB 1330
1100 IF C$=T$(3) GOSUB 1400
1110 IF C$=T$(4) GOSUB 1800
1120 IF C$=T$(5) GOSUB 1970
1130 RETURN
1140 REM *****
1150 REM *
1160 REM * ADD NEW ENTRY TO DATA BASE
1170 REM *
1180 REM *****
1190 IF NS < NM  GOTO 1220
1200    PRINT "CANNOT ADD NEW ENTRY"
1210    GOTO 1320
1220 LET M$="NAME"
1230 GOSUB 850
1240 LET N$(NS)=C$
1250 LET M$="DATE"
1260 GOSUB 850
1270 LET D$(NS)=C$
1280 LET M$="PROCEDURE"
1290 GOSUB 850
1300 LET P$(NS)=C$
1310 LET NS=NS+1
1320 RETURN
1330 REM *****
1340 REM *
1350 REM * MAKE A NEW DATA BASE IN MEMORY
1360 REM *
1370 REM *****
1380 LET NS=0
1385 PRINT "DATA BASE INITIALIZED"
1390 RETURN
1400 REM *****
1410 REM *
1420 REM * READ IN OLD FILE
1430 REM *
1440 REM *****
1450 PRINT "SET CASSETTE NUMBER ONE TO
     START OF OLD FILE."
1460 PRINT "THEN SET CASSETTE TO PLAY MODE."
1470 PRINT "HIT ENTER KEY WHEN READY TO PROCEED
1480 LET M$=""
```

```
1490 GOSUB 850
1500 GOSUB 1330
1505 PRINT "NOW READING FILE  "
1510 GOSUB 1590
1520 IF NI$=E$ GOTO 1560
1530    GOSUB 1660
1540    GOSUB 1590
1550    GOTO 1520
1560 PRINT "FILE SUCCESSFULLY READ "
1570 PRINT NS," RECORDS READ "
1580 RETURN
1590 REM *****
1600 REM *
1610 REM * READ A RECORD FROM A FILE
1620 REM *
1630 REM *****
1640 INPUT #-1,NI$,DI$,PI$
1650 RETURN
1660 REM *****
1670 REM *
1680 REM * COPY RECORD INTO MEMORY
1690 REM *
1700 REM *****
1710 IF NS<NM GOTO 1740
1720    PRINT "CANNOT COPY RECORD "
1730    GOTO 1790
1740 LET N$(NS)=NI$
1750 LET D$(NS)=DI$
1760 LET P$(NS)=PI$
1770 REM
1780 LET NS=NS+1
1790 RETURN
1800 REM *****
1810 REM *
1820 REM * WRITE OUT NEW DATA BASE
1830 REM *
1840 REM *****
1850 PRINT "SET CASSETTE NUMBER ONE TO START OF NEW FILE."
1860 PRINT "THEN SET CASSETTE TO RECORD MODE."
1870 PRINT "HIT ENTER KEY WHEN READY TO PROCEED..."
1880 LET M$=""
1890 GOSUB 850
1900 FOR I = 1 TO NS
1910     PRINT #-1,N$(I-1),D$(I-1),P$(I-1)
1920     NEXT I
1930 PRINT #-1,E$,E$,E$
1940 PRINT "FILE SUCCESSFULLY WRITTEN "
1950 PRINT NS," RECORDS WRITTEN "
1960 RETURN
1970 REM *****
1980 REM *
1990 REM * GENERATE LISTING ON SCREEN
2000 REM *
2010 REM *****
2020 GOSUB 2110
2030 LET M$="VALUE"
2040 GOSUB 850
2050 LET V1$=C$
2052 PRINT
2054 PRINT "LIST OF PATIENTS:"
2056 PRINT
2060 LET L=0
2070 FOR I = 1 TO NS
2080    GOSUB 2360
2090     NEXT I
2100 RETURN
2110 REM *****
2120 REM *
2130 REM * GET VALID FIELD NAME
2140 REM *
2150 REM *****
2160 LET M$="FIELD"
2170 GOSUB 850
2180 GOSUB 2260
2190 IF VF=T GOTO 2240
2200    PRINT "INVALID FIELD"
2210    GOSUB 850
2220    GOSUB 2260
2230    GOTO 2190
2240 LET F1$=C$
2250 RETURN
2260 REM *****
2270 REM *
2280 REM * TEST FOR VALID FIELD NAME
2290 REM *
2300 REM *****
2310 LET VF=F
2320 FOR I = 1 TO NF
2330    IF F$(I-1)=C$ LET VF=T
2340     NEXT I
2350 RETURN
2360 REM *****
2370 REM *
2380 REM * SELECT RECORD FOR OUTPUT
2390 REM *
2400 REM *****
2410 LET VR=F
2420 IF F1$<>F$(0) GOTO 2450
2430    IF V1$=N$(I-1) LET VR=T
2440    GOTO 2510
2450 IF F1$<>F$(1) GOTO 2480
2460    IF V1$=D$(I-1) LET VR=T
2470    GOTO 2510
2480 IF F1$<>F$(2) GOTO 2510
2490    IF V1$=P$(I-1) LET VR=T
2500    GOTO 2510
2510 IF VR=T GOSUB 2530
2520 RETURN
2530 REM *****
2540 REM *
2550 REM * WRITE OUT SELECTED RECORD AND SCROLL
2560 REM *
2570 REM *****
2580 LET L=L+1
2590 IF L<LM GOTO 2630
2600    LET M$=""
2610    GOSUB 850
2620    LET L=1
2630 PRINT N$(I-1),D$(I-1),P$(I-1)
2640 RETURN
```

Turning a Mirror on PC Readers

Earlier this year, Bud Anderson of Marketing Development surveyed a sample of our PC *subscription list. While we knew he was performing a marketing study, we did not know the details of the study or of the questionnaire he sent out. When we saw his results — a fascinating profile of you, the* PC *reader — we thought you'd like to see them, too.*

BY BUD ANDERSON

Last February, Marketing Development mailed a printed questionnaire to a random selection of 1000 *Personal Computing* subscribers. *PC* was selected as representative of the numerous magazines directed to personal computer users. The questionnaire was developed to help determine some of the major characteristics of the buyers of low-cost computer systems.

A total of 186 usable questionnaires were returned by the cut-off date of about three weeks. This return rate of 18.6 percent is quite good for this type of survey, considering there was no incentive for the respondents to answer except for their high interest in personal computers.

The following summary gives results of the survey by the major areas covered.

Bud Anderson is president of Marketing Development, 402 Border Road, Concord, MA 01742; (617) 369-5382. His complete study of The Under $10,000 Computer Systems Market, *from which this article is excerpted, is available from Marketing Development for $750.*

Josh Randall

Ownership, Location. Seventy-three percent of the respondents own their own personal computer.

Sixty-five percent use their computers solely in their home while 19 percent use their computers in the office. However, 14 percent of the remaining respondents use their personal computer in both home and office. This result shows that portability is an important feature of personal computers; many people want to use a computer in both the home and office.

Occupation/Area of Work. Since this question was open ended — the respondent selected his own phrase to describe his occupation — I received many different answers. The large number of occupations mentioned indicates that personal computers appeal to persons over a wide occupational spectrum.

Table 1 Occupation *

Engineers	15.8%
Education	9.7
Computer Programmers	7.1
Executives	5.6
Medical	5.1
Data Processing	5.1
Students	4.1
Military	4.1
Sales	3.1
Technicians/Specialists	3.1
Manufacturing	3.1
Other	36.1

*In this and other tables, rounding makes some totals come out not exactly 100%.

The most prevalent occupation among respondents was engineering. However, this group represented only 16 percent of the total occupations mentioned. Other occupations and areas of work receiving a high number of mentions included education, computer programmers, executives, medical and data processing. Table 1 gives a more detailed breakdown of the occupations mentioned.

Size of Business. The survey showed a greater use of personal computers in smaller type businesses than in larger type businesses. However, if we consider that there are many more small businesses than large businesses it's probably safe to say that personal computers are used by all businesses no matter what their size. Table 2 outlines the size of the companies using personal computers. The largest demand for personal computers is among those business locations with a relatively small number of employees, even if these locations are part of a larger company.

Table 2 Size of Business

Employees at Your Location	
0-4	36%
5-19	23
20-99	22
100+	19
Employees in Whole Company	
0-4	27%
5-19	20
20-99	19
100+	34

Applications. Respondents mentioned 465 applications for personal computers. Of this total, 240 were home related applications while 225 were business applications. Table 3 shows a breakdown of the most popular applications.

Table 3 Applications

Home	
Games	24 %
Finances/Taxes	17
Education	12.5
Instructional	6
Entertainment	4.5
Hobby	4
Budgeting	4
Record Keeping	4
Data Storage	2.5
Checkbook	2.5
Other	19
Business	
Word Processing	6.5
Payroll	5
Software Development	5
Inventory	5
Accounting	4.5
Statistics	3.5
Teaching	3.5
Bookkeeping	3
Mailing Lists	3
Small Business Programming	3
Economic Research	2.5
Other	55.5

Manufacturers. Radio Shack is the most widely used personal computer. Table 4 shows the companies mentioned most often as the manufacturer of the personal computer used by the respondents.

Cost of Computers. Of all of the computer systems purchased by the respondents, 99 percent cost under $10,000. Furthermore, 71 percent of the respondents spent under $2000 for their initial system, with the balance spending from $2000 to $10,000.

Most personal computer users (55%) spent less than $1000 on additional items for the computer after the initial purchase. However, 1 percent of the respondents spent $1000 to $3000 on additional items and 14 percent incurred over $3000 in additional expense.

Table 4 Manufacturers

Radio Shack	34.5%
Apple	9
Commodore	6.5
Imsai	5
Heath	5
MITS/Pertec	3
Processor Technology	3
Southwest Technical Products	2.5
DEC	2
North Star	2
Wang	2
Home View	1.5
MOS Technology	1.5
Motorola	1.5
Ohio Scientific	1.5
Polymorphic Systems	1.5
Other	18

Major items most often bought after the initial purchase included additional memory, disks, printers, software and video monitors.

Where people buy computers is one of the characteristics of the personal computer market which distinguishes it from other computer markets. Table 5 shows a breakdown of where people bought their computers. As you can see, retail stores dominate the under-$10,000 computer systems market. You can also see the strong position of Radio Shack stores in this market.

Table 5 Where Computers Are Purchased

Computer Stores	39%
Radio Shack Stores	25
Direct Mail Firm	15
Manufacturer	15
Other	6

Time Spent Evaluating Computers. Personal computer buyers spend a considerable amount of time evaluating computers before purchas-

ing one. Eighty-five percent of the respondents spent more than 10 hours in evaluation and over one-third spent over 100 hours.

Programming. Forty percent of the respondents developed their own programs while 13 percent used commercially available programs. However, 47 percent indicated they both developed their own programs and used commercially available programs.

BASIC, the most popular language, was used by 66 percent of the respondents.

Problems. Fifty-nine percent of the respondents had some sort of problem with their personal computers. The more common problems included bad memory chips, poor documentation, hardware malfunction, keyboard bounce, inadequate software, power supply, memory outages, printer malfunction, disk controller, I/O hardware and malfunctioning disk drives.

Forty-one percent of the respondents indicated no problems with their systems.

Improvements. Respondents did not hold back in giving suggestions as to what improvements they wanted in personal computers. In fact, they supplied 293 suggestions. The area mentioned most often was availability of inexpensive printers with decent copies (23 mentions). Other suggestions included more software (17 mentions), more I/O availability including communications interfaces (13), lower cost (12), more standardization (12), larger memory capacity (12), better software (10), better documentation (9) and improved graphics (8).

Industry problems. Problems in the personal computer industry mentioned most often included lack of standards (including interchangeability and compatibility, 33 mentions), cost (20 mentions), service (16), poor documentation (15), need for more software (14) and poor software.

Trends. Trends mentioned by respondents included price decreases (37 mentions), more software packages (11), widespread use (9), small business use (7), availability (5), peripherals (4) and turnkey operation (4).

Time Spent on Computer. Seventy-five percent of the respondents spend over 5 hours per week on their personal computer. The median response from the sample was 6 to 10 hours per week, with twenty-six percent spending this amount of time.

Thirty-eight percent said their computer use had increased since first buying the computer while 21 percent said usage had decreased. The balance indicated that their usage was about the same as in the beginning.

User Characteristics. Personal computer users represent a group with definite characteristics, including relatively young age level, predominately male, high income levels and high education attainment. Table 6 outlines user characteristics. One particularly interesting item is that over half the respondents have annual incomes in excess of $25,000 and 9 percent have annual incomes over $50,000. □

Table 6 Demographics

Age	
14-19	1.5%
20-24	6
25-34	37
35-44	31
45-64	23
65+	2.5
Sex	
Male	98%
Female	2
Income	
Under 10,000	4.5%
10,000-14,999	8.5
15,000-19,999	16
20,000-24,999	20
25,000-49,999	42
Over 50,000	9
Education	
None	4%
Grade School	1
High School	9
Less than 4 yr. College	14
4 yr. College	36
Master's	24
Doctorate	12

TRS-80: best seller among doctors

Radio Shack's TRS-80 is by far the best-selling computer among physicians, according to a recent survey of *Physicians Microcomputer Report* readers. Radio Shack accounted for 46.3% of the units sold to doctors during the last half of 1978, while Apple held second place with about 12% of the market.

Other computers popular among physicians included Alpha Micro, Imsai, Cromemco, DEC, Pertec and Processor Technology.

At present, less than 6% of the *Report*'s readers own microcomputers. But 1979 personal computer sales to doctors are predicted to increase nearly 400% over 1978 levels, the *Report* said, with sales ranging between $24 million and $36 million. The *Report* predicts Radio Shack will capture between 58% and 65% of the market (on a unit volume basis), while Apple will strengthen its position with 14% of the market. A Texas Instruments entry would give TI about 5% of the market.

In 1980, sales will increase 300% over 1979 sales, ranging between $84 and $96 million, the *Report* predicted.

The *Report* cautions that these unit volume figures are somewhat misleading since microcomputer system prices vary greatly. Most physicians purchase $1000 to $5000 computers to learn more about computer hardware and software capabilities. While some simple business and technical functions are being implemented on these low-cost micros, most existing medical software is written for mid-range computers costing $5000 to $12,000.

Dr. Gerald Orosz, the *Report*'s publisher, views 1979 as a transition year in which technological, manufacturing and marketing problems will be solved. He predicts that 1980 will see viable small medical business systems costing well under $10,000.

Subscriptions to the *Report* cost $25. Contact Dr. Orosz, *Physicians Microcomputer Report*, P.O. Box 6483, Lawrenceville, NJ 08648.

Readers Comment on Personal Computers

- It is an irresistable magnet. In fact, keeps me from switching jobs! It eats into my other work as a pathologist, nibbles at my home life and my wife hates it. I guess I'm an addict at programming. I don't really *use* it that much. I have not bought one myself for home use because: (1) still too expensive for what is offered and for the use I would make of it, (2) fear of theft (related to cost) and (3) opposition by spouse.
- I am very interested that my child should grow up very conversant with computers and I plan to do this by having a computer in the home.
- More and better consumer and end user education is needed.
- Until manufacturers can provide rapid (24 hour) maintenance on down-time, a personal computer is useless to the businessman.
- Any personal computer worth its salt should have joy sticks and high resolution graphics.
- They are a must for small sophisticated businessmen. They are also a great hobby for the whole family.
- After I educate myself in their use, I will find a use for them in my home, business and hobby.
- They are not for everyone, but many levels of sophistication are available. This will broaden the range of personal computer users.
- I think they are being oversold at this time. Market is limited. This is not the type of device which will be eventually found in the majority of households.
- They are certainly here to stay. Great future potential for software for these systems. Most early programs will prove to be junk.
- I would like to see a personal computer that would give stock market quotes in my home, and stock market graphics.
- Should become common in most homes in a decade or two, perhaps packaged a little differently.
- A fantastic leap forward in electronic technology. Will open doors for people in all walks of life!
- Paper is almost obsolete!
- At first I spent 10 hours a day with it and hardly slept. After the first month it was no longer such a novelty and I settled down to really work with it — plan things, coordinated time in view of other responsibilities. Imagine an apartment complex where each unit has a personal computing termina! and the CPU is run by the management. Security, menu-planning, banking: all controlled and operated by computer. I'm at work now on the design.
- The simpler, the better.
- A tool is only as good as the person that uses it.

Foto Finder

BY LOYD BULMER

Many photographers depend on their photos for partial or total income. And in only a short time of prolific shooting, even home shutterbugs can accumulate a huge stock of photos. Finding that one shot of a sunset can mean a dreaded, day-long search through stacks of paper. Here's a program that will help get you to the sunset — before the day's end.

Foto Finder was designed primarily for retrieval of information regarding 35 mm color slides, but has been modified for photo prints contained in various albums.

This program not only locates various photos, but also counts the number of photos contained in various categories. It also can count and retrieve information about other collections, such as scrapbooks or butterfly collections. Professional photographers could modify the "remarks" column to show when or how many copies of an item were sold.

The number of entries which can be stored depends on the available memory in your computer and the length of entries themselves. Note the limitations placed on the length of the string variables for the various fields. This was done to retrieve the information on one line of display and also to maximize the number of entries. Try experimenting with line 30 for the array dimension and memory clearance.

The program is written in Radio Shack Level II BASIC and should be easily translatable into other dialects of BASIC. Users with line printers should substitute LPRINT for PRINT in lines 1300, 1310, 1720, 1730, 1740, 1750 and 1760.

Adapting the program for disk drive would increase the storage of entries enormously — from about 300, using 16K RAM, to as many as 1400 per disk.

"Fail-safe" lines written into the program, such as line 180, and limitations placed on the number of characters in the various fields, such as line 220, can be eliminated. This restructuring will affect line 1700, and in turn, lines 1720 to 1740.

You can experiment with a "date-span" to replace or supplement the "date" command. While I considered this option in writing the program, I abandoned it in favor of constructing a simpler program which required fewer bytes.

The Sample Run concentrates more on the retrieval than the input. The sample begins with no data at all. If there is previous data stored on cassette tape, enter it into the CPU by first going to menu-command #2 and retrieving from tape. Additional data can then be entered via menu-command #1.

For data storage in a two-dimensional array, the computer automatically assigns record numbers. This number appears on the retrieval print-out as the last digit on the line and is used to correct an entry. The array eliminates the need for "open file" and "close file" commands.

"Retrieval" and "count" commands are executed through comparison of requested fields with the fields in memory, and printing the entire record when the fields match. Listings are separated by one line of dashes. A line of equal signs shows that the search is finished. A request for an item which is not in memory is answered with the heading line and a line of equal signs.

The computer compares the entire requested field with the fields in memory and only those totally equivalent will be retrieved. For instance, in the Sample Run, a request for description "sunset" would only produce record #1. It would not produce record #3 with"sunset beach".

Also in the sample run, the "location number" is my own numbering system for my collection. Line 9999 is a "test" line. Its appearance indicates something wrong in the program as entered.

The Program Listing contains a number of non-essential spaces which can be eliminated to produce a more compact program and reduce the number of bytes required for storage. □

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Program Listing

```
10 CLS:PRINT@405,"F O T O   F I N D E R"
20 FOR L = 1 TO 2500: NEXT
30 CLEAR 2000: DIM A$(200,5): PRINT
100 PRINTTAB(5)"HERE ARE THE CODES"
110 PRINTTAB(8)"1 TO INPUT"
120 PRINTTAB(8)"2 TO RETRIEVE"
130 PRINTTAB(8)"3 TO COUNT"
140 PRINTTAB(8)"4 TO CORRECT"
150 PRINTTAB(8)"5 TO EXIT"
160 PRINT: INPUT"USE ";Z
170 ON Z GOTO 200,370,1000,1400,1500
180 IF(Z<1) OR (Z>5) GOSUB 1770: GOTO 100
200 IF N = Ø THEN N = 1: GOTO 210
205 INPUT"STARTING NUMBER ";N
210 INPUT"GEOGRAPHIC LOCATION ";A$(N,1)
220 IF LEN(A$(N,1))> 15 GOSUB1700: GOTO 210
230 INPUT"DESCRIPTION ";A$(N,2)
240 IF LEN(A$(N,2))> 15 GOSUB1700: GOTO 230
250 INPUT"DATE ";A$(N,3)
260 INPUT"REMARKS ";A$(N,4)
270 IF LEN(A$(N,4))  12 GOSUB 1710: GOTO 260
280 INPUT "FOTO LOCATION NUMBERS ";A$(N,5)
285 INPUT "ANOTHER ENTRY ";Z$
290 IF Z$ = "YES" THEN N=N + 1: GOTO 210
300 INPUT"IS THIS DATA TO BE SAVED ";Z$
310 IF Z$ = "NO" GOTO 100
320 INPUT "PRESS 'ENTER' WHEN CASSETTE READY ";Z
325 PRINT #-1, N
330 FOR Q = 1 TO N
335 FOR L = 1 TO 5
340 PRINT #-1, A$(Q,L)
345 NEXT L
350 NEXT Q
360 PRINT "FINISHED WITH CASSETTE.": GOTO 100
370 IF N> Ø GOTO 450
375 INPUT "IS DATA TO COME FROM CASSETTE ";Z$
380 IF Z$ = "NO" GOTO 450
400 INPUT "PRESS 'ENTER' WHEN CASSETTE READY ";X
405 INPUT #-1, N
410 FOR Q = 1 TO N
415 FOR L = 1 TO 5
420 INPUT #-1, A$(Q,L)
425 NEXT L
430 NEXT Q
440 PRINT "FINISHED WITH CASSETTE.": GOTO 100
450 PRINTTAB(5)"HOW DO YOU WANT TO RETRIEVE?"
460 PRINTTAB(8)"1 - BY GEOGRAPHIC LOCATION"
470 PRINTTAB(8)"2 - BY DESCRIPTION"
480 PRINTTAB(8)"3 - BY DATE"
490 PRINTTAB(8)"4 - BY REMARKS"
500 PRINTTAB(8)"5 - BY LOCATION NUMBER"
510 PRINTTAB(8)"6 - BY COMBINATION"
520 INPUT"WHICH ";X
530 ON X GOTO 540, 560, 580, 600, 620, 710
535 GOSUB 1770: GOTO 450
540 INPUT"WHAT GEOGRAPHIC LOCATION "; Y$
550 GOTO 640
560 INPUT"WHAT DESCRIPTION "; Y$
570 GOTO 640
580 INPUT"WHAT DATE "; Y$
590 GOTO 640
600 INPUT"WHAT REMARKS "; Y$
610 GOTO 640
620 INPUT"WHAT LOCATION NUMBER "; Y$
630 GOTO 640
640 GOSUB 1720
650 FOR Q = 1 TO N
```

continued

```
660 IF Y$ = A$(Q,X) GOSUB 1740
670 NEXT
680 GOSUB 1760
690 INPUT"ANOTHER RETRIEVAL ";Z$
700 IF Z$ = "YES" THEN 450 ELSE 100
710 PRINTTAB(8)"WHAT COMBINATION IS WANTED?"
720 PRINTTAB(5)"1 - BY GEOGRAPHIC LOCATION AND DESCRIPTION"
730 PRINTTAB(5)"2 - BY GEOGRAPHIC LOCATION AND DATE"
740 PRINTTAB(5)"3 - BY GEOGRAPHIC LOCATION AND REMARKS"
750 PRINTTAB(5)"4 - BY DESCRIPTION AND DATE"
760 PRINTTAB(5)"5 - BY DESCRIPTION AND REMARKS"
770 PRINTTAB(5)"6 - BY DATE AND REMARKS"
780 INPUT"ENTER COMBINATION NUMBER "; W
790 ON W GOTO 800, 800, 800, 930, 930, 960
800 S=1:INPUT"'GEOGRAPHIC LOCATION' WANTED "; L$
810 IF LEN(L$) > 15 GOSUB 1700: GOTO 800
820 ON W GOTO 830, 860, 880
830 T=2: INPUT"'DESCRPTION' WANTED "; L1$
840 IF LEN(L1$)> 15 GOSUB 1700: GOTO 830
850 ON W GOTO 900,860, 880
860 T=3: INPUT"'DATE' WANTED ";L1$
870 ON W GOTO 9999, 900, 880, 900, 880
880 T=4: INPUT"'REMARKS' WANTED ";L1$
890 IF LEN(L1$) > 12 GOSUB 1710: GOTO 880
900 GOSUB 1720: FOR Q = 1 TO N
910 IF (L$ = A$(Q,S) ) AND (L1$ = A$(Q,T) ) GOSUB 1740
920 NEXT Q
925 GOSUB 1760: INPUT"ANOTHER COMBINATION WANTED "; Z$
926 IF Z$ = "YES" THEN 710 ELSE 100
930 S = 2: INPUT"'DESCRIPTION' WANTED "; L$
940 IF LEN (L$) > 15 GOSUB 1700: GOTO 930
950 ON W GOTO 9999, 9999, 9999, 860, 880
960 S=3: INPUT"'DATE' WANTED "; L$
970 GOTO 880
1000 PRINTTAB(5)"WHAT TOTALS ARE REQUIRED?"
1010 PRINTTAB(8)"1 - GEOGRAPHIC LOCATION"
1020 PRINTTAB(8)"2 - DESCRIPTION"
1030 PRINTTAB(8)"3 - DATE"
1040 PRINTTAB(8)"4 - REMARKS"
1050 INPUT"USE ";M: P=Ø
1060 ON M GOTO 1070, 1100, 1130, 1150
1065 GOSUB 1770: GOTO 1000
1070 INPUT"WHICH GEOGRAPHIC LOCATION "; Y$
1080 IF LEN(Y$) > 15 GOSUB 1700: GOTO 1070
1090 GOTO 1180
1100 INPUT"WHICH DESCRIPTION "; Y$
1110 IF LEN(Y$) > 15 GOSUB 1700: GOTO 1100
1120 GOTO 1180
1130 INPUT"WHICH DATE ";Y$
1140 GOTO 1180
1150 INPUT"WHICH REMARKS "; Y$
1160 IF LEN(Y$) > 12 GOSUB 1710: GOTO 1150
1180 FOR Q = 1 TO N
1190 IF Y$ = A$(Q,M) THEN P = P + 1
1200 NEXT
1210 ON M GOSUB 1220, 1240, 1260, 1280
1215 GOTO 1300
1220 C$ = "GEOGRAPHIC LOCATION"
1230 RETURN
1240 C$ = "DESCRIPTION"
1250 RETURN
1260 C$ = "DATE"
1270 RETURN
1280 C$ = "REMARKS"
1290 RETURN
1300 PRINT"THERE ARE ";P;"FOTOS LISTED UNDER
     THE HEADING '";C$;"'"
1310 PRINT"FOR THE CRITERION OF "; Y$
1320 GOSUB 1760
1330 INPUT"ANOTHER COUNT ";Z$
```

continued

```
1340 IF Z$ = "YES" THEN 1000 ELSE 100

1400 INPUT"WHICH RECORD REQUIRES CORRECTING ";Q

1410 GOSUB 1720: GOSUB 1740

1420 INPUT"WHICH FIELD NEEDS CORRECTING "; F

1430 INPUT"ENTER NEW FIELD ";A$(Q,F)

1440 PRINT"HERE IS THE REVISED RECORD.":
     GOSUB 1720: GOSUB 1740

1450 INPUT"ANOTHER CORRECTION "; Z$

1460 IF Z$ = "YES" THEN 1400 ELSE 100

1500 INPUT"IS THIS SESSION ENDED ";Z$

1510 IF Z$ = "NO" THEN 100

1520 PRINT"IF CHANGES WERE MADE TO THE
     DATA BASE ARE THEY TO BE"

1530 INPUT"SAVED "; Z$

1540 IF Z$ = "YES" THEN 320

1550 PRINT"THESE PROCEEDINGS ARE NOW CONCLUDED."

1560 FOR L = 1 TO 1500: NEXT

1570 CLS: PRINT @ 339,"THIS PROGRAM WAS PREPARED"

1580 PRINT @ 478,"BY"

1590 PRINT @ 596,"PRIMERO CONSULTANTS INC."

1600 FOR L = 1 TO 200:NEXT: END

1700 PRINT"--->FIELD MUST NOT EXCEED 15 CHARACTERS.
     RE-INPUT.": RETURN

1710 PRINT"--->FIELD MUST NOT EXCEED 12 CHARACTERS.
     RE-INPUT.": RETURN

1720 PRINT"   GEOGRAPHIC      DESCRIPTION    DATE
     REMARKS   LOCATION #"

1730 PRINT"   LOCATION";TAB(50)"NMBR": RETURN

1740 PRINT A$(Q,1); TAB(18) A$(Q,2); TAB(32) A$(Q,3);
     TAB(39) A$(Q,4); TAB(49 A$(Q,5); TAB(58) Q

1750 PRINTSTRING$(63,"-"):RETURN

1760 PRINTSTRING$(63,"="):RETURN

1770 PRINT"WRONG NUMBER.  TRY AGAIN.": RETURN


9999 PRINT"WHAT'S UP DOC?"
```

Sample Run

```
HERE ARE THE CODES
   1 TO INPUT
   2 TO RETRIEVE
   3 TO COUNT
   4 TO CORRECT
   5 TO EXIT

USE ? 1
GEOGRAPHIC LOCATION ?  HAWAII
DESCRIPTION ?  SUNSET
DATE ?  1978
REMARKS ?  SHIPS
FOTO LOCATION NUMBERS ?  99-A
ANOTHER ENTRY ?  YES
GEOGRAPHIC LOCATION ?  HAWAII
DESCRIPTION ?  VOLCANO
DATE ?  1978
REMARKS ?
FOTO LOCATION NUMBERS ?  99-C
ANOTHER ENTRY ?  YES
GEOGRAPHIC LOCATION ?  HAWAII
DESCRIPTION ?  SUNSET BEACH
DATE ?  1977
REMARKS ?  HIGH SURF
FOTO LOCATION NUMBERS ?  99-C
ANOTHER ENTRY ?  NO

IS THIS DATA TO BE SAVED ?  YES
PRESS 'ENTER' WHEN CASSETTE READY ?
FINISHED WITH CASSETTE.
     HERE ARE THE CODES
        1 TO INPUT
        2 TO RETRIEVE
        3 TO COUNT
        4 TO CORRECT
        5 TO EXIT


USE?  2
     HOW DO YOU WANT TO RETRIEVE
        1 - BY GEOGRAPHIC LOCATION
        2 - BY DESCRIPTION
```

continued

```
        3 - BY DATE
        4 - BY REMARKS
        5 - BY LOCATION NUMBER
        6 - BY COMBINATION
    WHICH?  1
    WHAT GEOGRAPHIC LOCATION ?  HAWAII

GEOGRAPHIC DESCRIPTION    DATE   REMARKS  LOCATION  #
 LOCATION                                  NMBR
 HAWAII    SUNSET         1978   SHIPS    99-A      1
 ---------------------------------------------------
 HAWAII    VOLCANO        1978            99-C      2
 ---------------------------------------------------
 HAWAII    SUNSET BEACH   1977   HIGH SURF 99-C     3
 ---------------------------------------------------
 ===================================================

 ANOTHER RETRIEVAL ?  YES
     HOW DO YOU WANT TO RETRIEVE
        1 - BY GEOGRAPHIC LOCATION
        2 - BY DESCRIPTION
        3 - BY DATE
        4 - BY REMARKS
        5 - BY LOCATION NUMBER
        6 - BY COMBINATION
 WHICH ?  6
        WHAT COMBINATION IS WANTED
     1 - BY GEOGRAPHIC LOCATION AND DESCRIPTION
     2 - BY GEOGRAPHIC LOCATION AND DATE
     3 - BY GEOGRAPHIC LOCATION AND REMARKS
     4 - BY DESCRIPTION AND DATE
     5 - BY DESCRIPTION AND REMARKS
     6 - BY DATE AND REMARKS


 ENTER COMBINATION NUMBER ?  4
 'DESCRIPTION' WANTED ?  SUNSET BEACH
 'DATE' WANTED ?  1977

  GEOGRAPHIC  DESCRIPTION   DATE   REMARKS  LOCATION  #
   LOCATION                                  NMBR
HAWAII        SUNSET BEACH  1977   HIGH SURF 99-C     3
-----------------------------------------------------
=====================================================
```

COMPUTE 4

BY MARK SAWUSCH

Compute Four is a computer program inspired by Milton Bradley's "Connect Four" game. "Connect Four" lies somewhere between tic-tac-toe and Go-moku and the goal is to arrange (on a 6 × 8 grid) four of your playing pieces in a row before your opponent does. However, two new dimensions are added which make the computer game different from "Connect Four." First, your opponent is a computer governed by strict logic; and second, the element of gravity is introduced to make the game more intriguing. You will find that the computer can not be beaten unless you arrange for two winning moves to be made during the same turn. That maneuver will require a lot of skill and a little bit of luck.

The program is unique compared to other board-search programs (checkers, chess, etc.) because a one-dimensional array is used to store both the position and the ownership of pieces on the board. The traditional approach uses a two- or three-dimensional array. In a 3-dimension XYZ array, the X represents the horizontal board distance; Y, the vertical distance; and Z, various additional information. The one-dimensional array is easier to use in Compute Four. To accommodate this array an unusual board numbering technique is used which looks like Diagram #1.

If each number on the board is separated by a comma between the two digits, the equivalent of a two dimensional index is achieved. For example, space #68 = 6, 8 — six spaces in the horizontal x direction and eight spaces in the vertical y direction. Statements 1030 and 1040 accomplish this purpose: if n= the # of the space then y=INT(n/10) and x=(n-(INT(n/10)).

Whenever a human player inputs a move, the computer must search for three-in-a-row of its own or the opponent's pieces; other combinations which could result in a winning move (such as two spaces occupied, the third unoccupied, and the fourth occupied); two-in-a-row of its own pieces; and if none of these situations exists, the computer makes a random move.

The search technique is exemplified in lines 2002-2130. At the start of the program all array elements, A(X), are set = O. As each move is made to square "n" the element A(n) is set = to a number indicating who owns that square (1=computer, 2=human). After a move by the human, the computer searches through every array element until it finds a square occupied by the computer itself (lines 2002-2004). Then, (in lines 2010-2130) every possible combination (diagonally, vertically or horizontally) of three-in-a-row of its own pieces is investigated by this technique:

Observe Diagram #2, which represents a portion of the playing board:

When square "n" (in this case #55) is found to belong to the computer (because A (55)=1) it then wants to know if space "n" is linearly adjacent to two of its other pieces, making three-in-a-row. To determine whether the square below (#65) belongs to it, the computer finds the value of A(n+10). If A(n+10)=1 (1 is used to indicate that the computer owns that square) then it has found two-in-a-row. Now if A(n-10)=1 there is three-in-a-row. To find three-in-a-row horizontally it searches A(n+1) and A(n-1); diagonally, it searches A(n+9), A(n-9), A(n+11), and A(n-11). This type of search is more difficult when using a two dimensional array, as both x and y must be altered in order to search adjacent squares.

11	12	13	14	15	16	17	18
21	22	23	24	25	26	27	28
31	32	33	34	35	36	37	38
41	42	43	44	45	46	47	48
51	52	53	54	55	56	57	58
61	62	63	64	65	66	67	68

Diagram 1

Running the Program

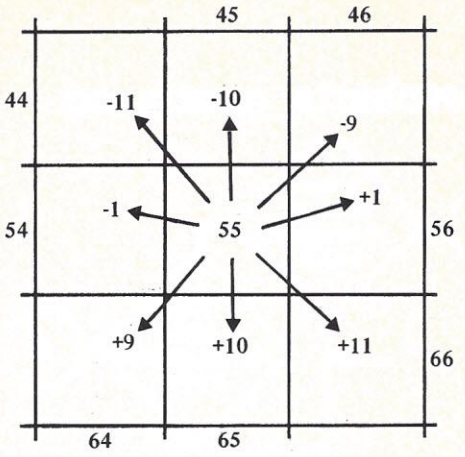
Compute Four was written for the Radio Shack TRS-80. If you are using a TRS-80 with Level I BASIC delete the DIM A(110) statement on line #15. The program, as written, requires about 5K memory, but this figure can be reduced to under 4K by deleting the game instructions (lines 4-13); and the "let" commands. Also, the use of abbreviations: as well as the use of multiple statements per line will also help.

If you are not using the TRS-80 the following changes must be made: delete "cls", "print at", "set", and other commands not available in your BASIC. Almost all of these special TRS-80 commands are used only in displaying game-board graphics. Thus, these portions must be re-written for your own display system.

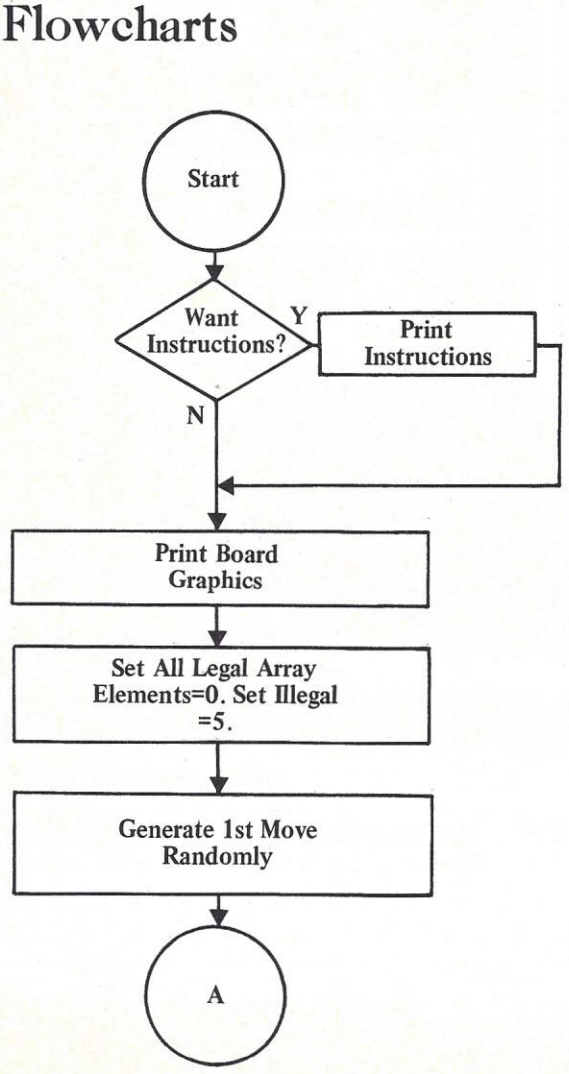
An extended use of READ-DATA statements and subroutines were tried and they shortened the program. However, this method required too much computer time and was, therefore, deleted.

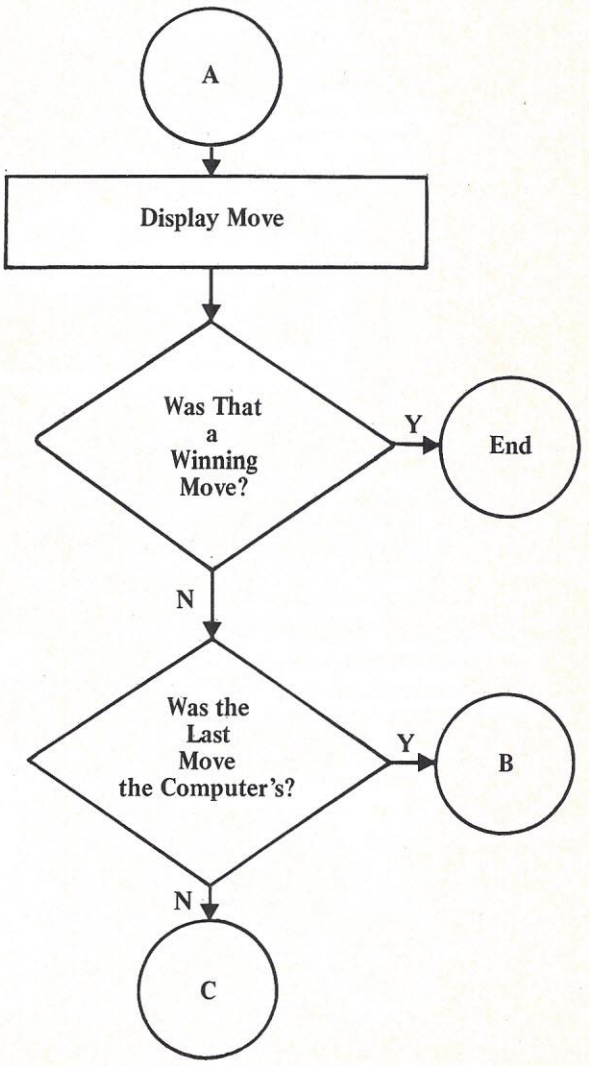
Those interested in writing chess progams may wish to alter the numbering system of the chess board to one similar to that of Compute Four. Not only will this be more comfortable to enter into the program; but also, it may be faster to execute. □

Diagram 2

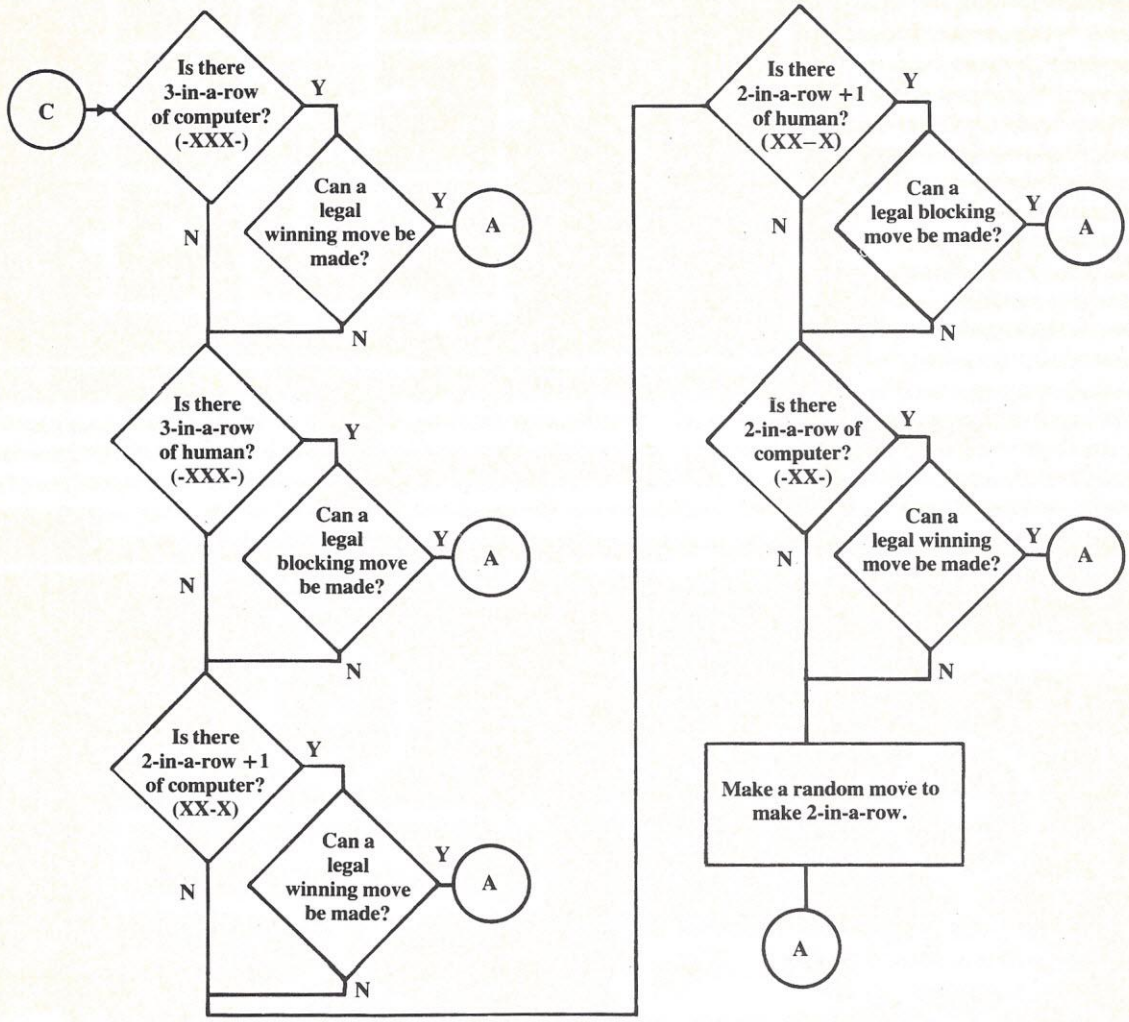


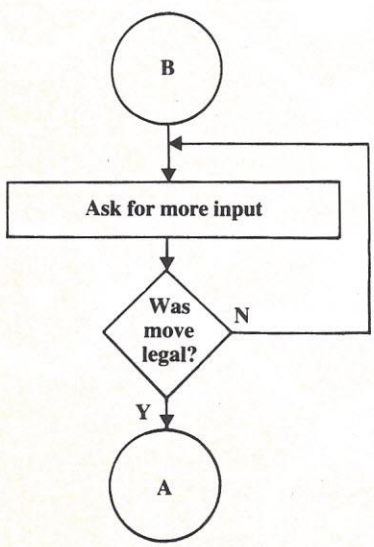
Flowcharts





Flowcharts continued





Program Listing

```
1 REM COMPUTE  FOUR-(C)1978 MARK SAWUSCH-MAY NOT BE SOLD
2 CLS:PRINT@342,"****COMPUTE FOUR****"
3 PRINT@400,"PROGRAM BY MARK SAWUSCH 4/27/78":FORA=1TO1000:NEXTA
4 CLS:INPUT"DO YOU NEED INSTRUCTIONS (1=YES,2=NO)";A
5 ONAGOTO6,15:GOTO4
6 PRINT"THE OBJECT OF COMPUTE FOUR IS TO BE THE FIRST PLAYER TO PLACE"
7 PRINT"FOUR OF YOUR PIECES IN A ROW HORIZONTALLY,DIAGONALLY,OR"
8 PRINT"VERTICALLY ON A GAME BOARD.  IMAGINE THAT THE GAME BOARD IS"
9 PRINT"STANDING VERTICALLY.  PLAYERS TAKE TURNS 'DROPPING' ONE OF"
10 PRINT"THEIR PIECES IN ANY COLUMN, THUS EACH PIECE WILL TRAVEL DOWN"
11 PRINT"TO THE LOWEST UNOCCUPIED SQUARE (IT WILL HAVE THE HIGHEST"
12 PRINT"NUMBER).  TO ENTER YOUR MOVE TYPE THE BOX #.  THE COMPUTER'S "
13 PRINT"PIECES ARE SOLID WHITE.  TYPE ENTER WHEN READY.":INPUTA
15 B=9:Y=0:CLS:DIMA(110)
```

Program Listing continued

```
20 READA
30 LETB=B+2
40 FORM=1TO8
50 PRINT@(A),B;
60 LETA=A+8
70 LETB=B+1
80 IFB>68THENGOTO120
90 NEXTM
100 GOTO20
110 DATA65,193,385,513,641,769
120 FORA=11TO68:LETA(A)=0:NEXTA:LETX=19
122 FORA=1TO5:LETA(X)=5:LETX=X+1:LETA(X)=5
124 LETX=X+9:NEXTA:FORX=69TO79:LETA(X)=5:NEXTX
125 FORA=1TO10:A(A)=5:NEXTA
130 FORX=0TO127
140 SET(X,Y)
150 NEXTX
160 LETY=Y+7
170 IFY=42THENLETY=41
180 IFY>41THENGOTO200
190 GOTO130
200 LETX=0
210 FORY=0TO41
220 SET(X,Y)
230 NEXTY
240 LETX=X+16
250 IFX=128THENLETX=127
260 IFX>129THENGOTO291
270 GOTO210
291 PRINT@(960),"";
295 REM COMPUTER'S TURN FIRST
300 T=1:J=1
301 N=RND(4)+62
302 GOTO1000
905 PRINT@(896),"PLEASE INPUT YOUR MOVE:";
910 INPUTN
911 IF(A(N+10)=0)+(A(N)<>0)GOTO915
912 GOTO1000
915 PRINT@(896),"PAY ATTENTION TO GRAVITY- RE-ENTER YOUR MOVE";
916 GOTO910
1000 LETA(N)=T
1005 PRINT@(896),"
1030 LETY=INT(N/10)*7-7
1040 LETX=(N-(INT(N/10)*10))*16-8
1055 IFT=2GOTO1210
1060 FORA=1TO7
1070 FORB=1TO6
1080 SET(A+X,B+Y)
1085 NEXTB:NEXTA:GOSUB10000
1090 T=2:GOTO905
1210 FORA=1TO7
1211 FORB=1TO5STEP2
1215 SET(A+X,Y+B)
1220 NEXTB:NEXTA:GOSUB10000
1235 LETT=1:GOTO2000
2000 P=1:PRINT@(896),"I'M THINKING...";
2001 S=0
2002 FORA=1TO68
2003 IFA(A)=PGOTO2006
2004 NEXTA:IFP=2GOTO3000
2005 P=2:GOTO2002X
2006 J=-10:IFA(A+J)=PGOSUB2025
2007 IFS=5GOTO1000
2008 J=9:IFA(A+J)=PGOSUB2025
2009 IFS=5GOTO1000
2010 J=-9:IFA(A+J)=PGOSUB2025
2011 IFS=5GOTO1000
2012 J=1:IFA(A+J)=PGOSUB2025
2013 IFS=5GOTO1000
2014 J=-1:IFA(A+J)=PGOSUB2025
2015 IFS=5GOTO1000
2016 J=10:IFA(A+J)=PGOSUB2025
2017 IFS=5GOTO1000
2018 J=11:IFA(A+J)=PGOSUB2025
2019 IFS=5GOTO1000
2020 J=-11:IFA(A+J)=PGOSUB2025
2021 IFS=5GOTO1000
2022 GOTO2004
2025 IFA(A+2*J)<>PRETURN
2026 IFA(A+3*J)<>0RETURN
2027 IFA(A+3*J+10)=0RETURN
2030 S=5:N=A+3*J:RETURN
3000 V=0:P=1:M=0
3001 FORA=11TO68:IFA(A)=PGOTO3005
3002 NEXTA:ONMGOTO3080,4000
3003 IFP=2GOTO3050
3004 P=2:GOTO3001
3005 J=-10:IFA(A+J)=PGOSUB3025
3006 IFV=5GOTO1000
3007 J=9:IFA(A+J)=PGOSUB3025
3008 IFV=5GOTO1000
3009 J=-9:IFA(A+J)=PGOSUB3025
3010 IFV=5GOTO1000
3011 J=1:IFA(A+J)=PGOSUB3025
3012 IFV=5GOTO1000
3013 J=-1:IFA(A+J)=PGOSUB3025
3014 IFV=5GOTO1000
3015 J=11:IFA(A+J)=PGOSUB3025
3016 IFV=5GOTO1000
3017 J=-11:IFA(A+J)=PGOSUB3025
3018 IFV=5GOTO1000
3020 GOTO3002
3025 ONMGOTO3055,3083:IFA+3*J<11RETURN
3026 IFA(A+3*J)<>PRETURN
3027 IFA(A+2*J)<>0RETURN
3028 IFA(A+2*J+10)=0RETURN
3029 V=5:N=A+2*J:RETURN
3050 M=1:P=1:GOTO3001
3055 IFA+3*J<11RETURN
3060 IFA(A+3*J)<>0RETURN
3061 IFA(A+2*J+20)=0RETURN
3063 IFA(A+2*J)<>0RETURN
3064 IFA(A+3*J+10)=0RETURN
3065 V=5:N=A+3*J:RETURN
3080 M=2:P=1:GOTO3001
3083 IFA(A+2*J)<>0RETURN
3085 IFA(A+2*J+10)=0RETURN
3087 IFA(A+3*J)<>0RETURN
3089 V=5:N=A+2*J:RETURN
4000 E=0:FORG=11TO68
4010 IFA(G)=1GOTO4030
4020 NEXTG
4030 IFA(G+10)=0NEXTG
4035 N=RND(8)
4040 ON N GOTO 4100,4200,4300,4400,4500,4510,4520,4530
4100 E=1:N=G-10:IF(A(N)=0)*(A(N+10)<>0)GOTO1000
4200 N=G+9: IF(A(N)=0)*(A(N+10)<>0)GOTO1000
4300 N=G-9: IF(A(N)=0)*(A(N+10)<>0)GOTO1000
4400 N=G+1: IF(A(N)=0)*(A(N+10)<>0)GOTO1000
4500 N=G-1: IF(A(N)=0)*(A(N+10)<>0)GOTO1000
4510 N=G+10:IF(A(N)=0)*(A(N+10)<>0)GOTO1000
4520 N=G+11:IF(A(N)=0)*(A(N+10)<>0)GOTO1000
4530 N=G-11:IF(A(N)=0)*(A(N+10)<>0)GOTO1000
4600 IFE=1THENNEXTG
4601 GOTO4100
5100 PRINT"TIE GAME";:GOTO8025
8000 IFT=2GOTO8100
8010 PRINT@(960),"CHALK ONE UP FOR ME";
8020 FORA=1TO1000:NEXTA
8025 PRINT@(960),"FOR ANOTHER GAME TYPE 'RUN'";
8030 END
8100 FORA=1TO10
8200 PRINT@(960),"YOU WON!";
8300 FORB=1TO100:NEXTB
8400 PRINT@(960),"
8450 FORB=1TO50:NEXTB
8500 NEXTA:GOTO8025
10000 X=1:A=1
10001 ONAGOTO10002,10003,10004,10005,10006
10002 A=2:J=9:GOTO10008
10003 A=3:J=11:GOTO10008
10004 A=4:J=1:GOTO10008
10005 A=5:J=10:GOTO10008
10006 RETURN
10008 X=1:IFA(N+J)=TTHENX=X+1
10010 IFA(N+2*J)=TTHENX=X+1
10015 IFN+3*J<11GOTO10030
10020 IFA(N+3*J)=TTHENX=X+1
10030 IFA(N-J)=TTHENX=X+1
10040 IFN-2*J<11GOTO10210
10150 IFA(N-2*J)=TTHENX=X+1
10200 IFA(N-3*J)=TTHENX=X+1
10210 IFX>=4GOTO10240
10220 GOTO10001
10230 RETURN
10240 IF(A(N-3*J)=T)*(A(N-2*J)=T)*(A(N-J)=T)GOTO8000
10250 IF(A(N-2*J)=T)*(A(N-J)=T)*(A(N+J)=T)GOTO8000
10260 IF(A(N-J)=T)*(A(N+J)=T)*(A(N+2*J)=T)GOTO8000
10270 IF(A(N+J)=T)*(A(N+2*J)=T)*(A(N+3*J)=T)GOTO8000
10280 RETURN
```

Three Practical Programs

BY LON POOLE and MARY BORCHERS

Recipe Cost

If you've got the budget blues but still want to throw that dinner party, why not calculate exactly how much it'll cost you to cook each dish? With the following program you can figure not only the cost of each recipe, but the cost per serving. You'll know which dishes will accommodate the number of guests and your budget.

For each ingredient you must provide the purchase price, the amount purchased, the amount used in the recipe, and the number of recipe units per purchase unit.

As an example, Figure 1 shows a recipe for strawberry shortcake. Calculate the cost of the recipe and the cost per serving. What would the cost per serving be if one cake serves 12? The conversion factors and price per ingredient are supplied.

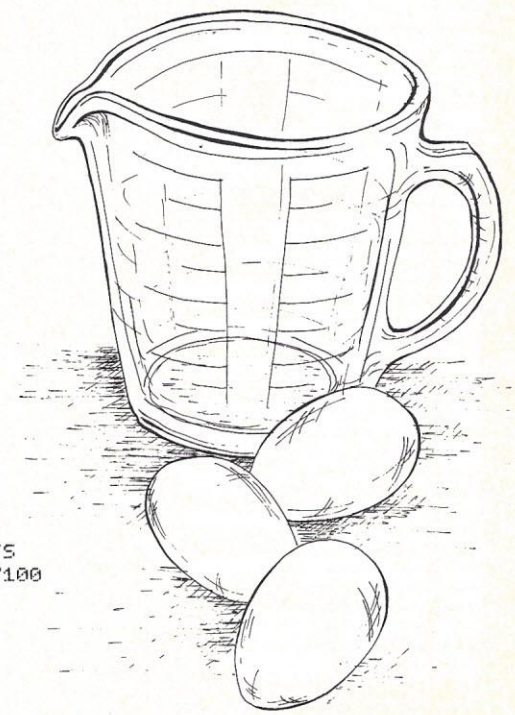
Strawberry Shortcake — 8 servings

3 c. flour	2.5 c./lb.	$1.59	5 lb.
3¼ tsp. baking powder	15 tsp./oz.	.43	4 oz.
¼ c. sugar	2 c./lb.	1.24	5 lb.
1¼ tsp. salt	6 tsp./oz.	.29	1 lb.
½ c. butter	2 c./lb.	1.49	1 lb.
1 egg	12/doz.	.75	1 doz.
⅔ c. milk	4 c./qt.	.40	1 qt.
3 pts strawberries	—	.49	1 pt.
½ pt. whipping cream	—	.59	½ pt.

Figure 1

Program Listing

```
10 PRINT "RECIPE COST"
20 PRINT
29 REM - STATEMENTS 30 TO 180 REQUEST USER INPUT
30 PRINT "NUMBER OF INGREDIENTS";
40 INPUT N
49 REM - LOOP TO REQUEST DATA FOR EACH INGREDIENT
50 FOR I=1 TO N
60 PRINT "INGREDIENT"; I; ":"
70 PRINT "  COST FOR BULK UNIT IN STORE";
80 INPUT C
90 PRINT "  NUMBER OF UNITS IN BULK";
100 INPUT U
110 PRINT "  NUMBER OF RECIPE UNITS PER BULK UNIT";
120 INPUT P
130 PRINT "  NUMBER OF RECIPE UNITS CALLED FOR";
140 INPUT R
149 REM - SUM COST OF EACH INGREDIENT PER AMOUNT USED
150 P=P+C/U/P*R
160 NEXT I
170 PRINT "NUMBER OF SERVINGS";
180 INPUT S
190 PRINT
199 REM - ROUND OF COSTS TO NEAREST CENT, PRINT RESULTS
200 PRINT "TOTAL COST FOR 1 RECIPE = $"; INT(P*100+.5)/100
210 PRINT "COST PER SERVING = $"; INT(P/S*100+.5)/100
220 PRINT
229 REM - CALCULATE ALTERNATIVE PRICE PER SERVING?
230 PRINT "CHANGE NUMBER OF SERVINGS (1=YES, 0=NO)";
240 INPUT N
250 IF N=1 THEN 170
260 END
```



Sample Run

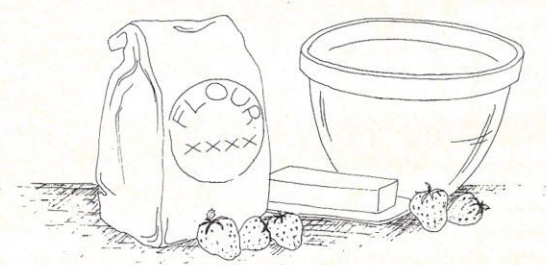
```
NUMBER OF INGREDIENTS? 9
INGREDIENT 1 :
  COST FOR BULK UNIT IN STORE? 1.59
  NUMBER OF UNITS IN BULK? 5
  NUMBER OF RECIPE UNITS PER BULK UNIT? 2.5
  NUMBER OF RECIPE UNITS CALLED FOR? 3

INGREDIENT 2 :
  COST FOR BULK UNIT IN STORE? .43
  NUMBER OF UNITS IN BULK? 4
  NUMBER OF RECIPE UNITS PER BULK UNIT? 15
  NUMBER OF RECIPE UNITS CALLED FOR? 3.25

INGREDIENT 3 :
  COST FOR BULK UNIT IN STORE? 1.24
  NUMBER OF UNITS IN BULK? 5
  NUMBER OF RECIPE UNITS PER BULK UNIT? 2
  NUMBER OF RECIPE UNITS CALLED FOR? .25

INGREDIENT 4 :
  COST FOR BULK UNIT IN STORE? .29
  NUMBER OF UNITS IN BULK? 1
  NUMBER OF RECIPE UNITS PER BULK UNIT? 96
  NUMBER OF RECIPE UNITS CALLED FOR? 1.25

INGREDIENT 5 :
  COST FOR BULK UNIT IN STORE? 1.49
  NUMBER OF UNITS IN BULK? 1
  NUMBER OF RECIPE UNITS PER BULK UNIT? 2
  NUMBER OF RECIPE UNITS CALLED FOR? .5

INGREDIENT 6 :
  COST FOR BULK UNIT IN STORE? .75
  NUMBER OF UNITS IN BULK? 1
  NUMBER OF RECIPE UNITS PER BULK UNIT? 12
  NUMBER OF RECIPE UNITS CALLED FOR? 1

INGREDIENT 7 :
  COST FOR BULK UNIT IN STORE? .40
  NUMBER OF UNITS IN BULK? 1
  NUMBER OF RECIPE UNITS PER BULK UNIT? 4
  NUMBER OF RECIPE UNITS CALLED FOR? .6666667

INGREDIENT 8 :
  COST FOR BULK UNIT IN STORE? .49
  NUMBER OF UNITS IN BULK? 1
  NUMBER OF RECIPE UNITS PER BULK UNIT? 1
  NUMBER OF RECIPE UNITS CALLED FOR? 3

INGREDIENT 9 :
  COST FOR BULK UNIT IN STORE? .59
  NUMBER OF UNITS IN BULK? 1
  NUMBER OF RECIPE UNITS PER BULK UNIT? 1
  NUMBER OF RECIPE UNITS CALLED FOR? 1

NUMBER OF SERVINGS? 8

TOTAL COST FOR 1 RECIPE = $ 3
COST PER SERVING = $ .38

CHANGE NUMBER OF SERVINGS (1=YES,0=NO)? 1
NUMBER OF SERVINGS? 12

TOTAL COST FOR 1 RECIPE = $ 3
COST PER SERVING = $ .25

CHANGE NUMBER OF SERVINGS (1=YES,0=NO)? 0

END PROGRAM
```

Option

As you become familiar with the operation of this program you may wish to shorten it by entering the information required for each ingredient on one line. The necessary program changes are listed following the example below.

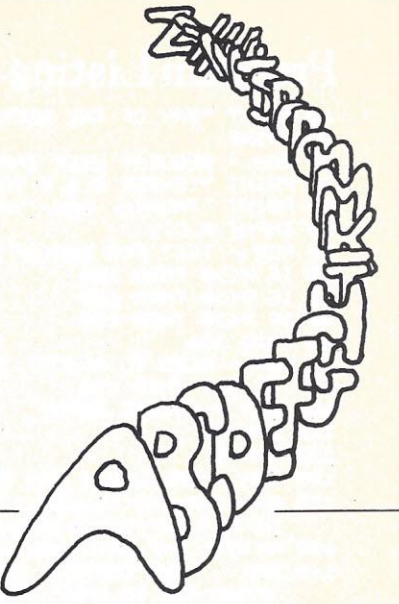
Example:
Calculate the cost per serving of Strawberry Shortcake in the previous example when it is served without cream.

```
10 PRINT "RECIPE COST"
:
50 FOR I=1 TO N
55 REM - ENTER C,U,F,R
56 REM - WHERE C=COST FOR BULK UNIT
57 REM -       U=NUMBER UNITS IN BULK UNIT
58 REM -       F=RECIPE UNITS PER BULK UNIT
59 REM -       R=NUMBER RECIPE UNITS CALLED FOR
60 PRINT "INGREDIENT";I;
70 INPUT C,U,F,R
149 REM - SUM COST OF EACH INGREDIENT PER

:
260 END
```




```
:RUN
RECIPE COST

NUMBER OF INGREDIENTS? 8
INGREDIENT 1 ? 1.59,5,2.5,3
INGREDIENT 2 ? .43,4,15.3 25
INGREDIENT 3 ? 1 24,5,2,.25
INGREDIENT 4 ? .29,1,96,1.25
INGREDIENT 5 ? 1.49,1,2,.5
INGREDIENT 6 ? .75,1,12,1
INGREDIENT 7 ? .40,1,4,.6666667
INGREDIENT 8 ? .49,1,1,3
NUMBER OF SERVINGS? 8

TOTAL COST FOR 1 RECIPE = $ 2.41
COST PER SERVING = $ .3

CHANGE NUMBER OF SERVINGS (1=YES,0=NO)? 1
NUMBER OF SERVINGS? 12

TOTAL COST FOR 1 RECIPE = $ 2.41
COST PER SERVING = $  2

CHANGE NUMBER OF SERVINGS (1=YES,0=NO)? 0

END PROGRAM
```

Alphabetize



Alphabetizing lists of words or phrases is usually considered a time-consuming and tedious task. Now you can program your computer to take care of it for you.

Numbers may be part of an alphanumeric phrase. However, they will not be put into numeric order unless they contain the same number of digits. Numbers with fewer digits must be justified to the right by prefixing zeros. Thus, if the numbers you are sorting range into the hundreds, the number 13 would be entered as 013, 20 would be 020, and so forth.

To save memory space, the array at statement 70 should be limited to the maximum number of terms you wish alphabetized. The dimension statement should be altered in the following manner:

70 DIM A$(N)

where N = the number of items to be alphabetized.

Program Listing

```
10 PRINT "ALPHABETIZE"
20 PRINT
30 PRINT "(TO END PROGRAM ENTER 0)
40 PRINT "NUMBER OF ITEMS";
50 INPUT Y
59 REM - END PROGRAM?
69 REM - LIMIT ARRAY TO MAXIMUM NUMBER OF ITEMS TO BE ENTERED IN
 ONE RUN
70 DIM A$(25)
80 FOR I=1 TO Y
90 PRINT "ITEM";I;
100 INPUT A$(I)
110 NEXT I
119 REM - LOOP TO ALPHABETIZE DATA
1010 M=Y
1017 REM - THE SORT TECHNIQUE USED IN LINES 1000-1180 COMPARES D
ATA ITEMS IN DIMINISHING INCREMENTS.
1018 REM - THE FIRST PASS COMPARES ITEMS N/2 ELEMENTS APART, THE
 SECOND (N/2)/2 ELEMENTS APART,
1019 REM - AND SO ON UNTIL THE INCREMENT IS EXHAUSTED.
1020 M=INT(M/2)
1030 IF M=0 THEN 1190
1040 K=Y-M
1050 J=1
1060 I=J
1070 L=I+M
1090 IF A$(I)<=A$(L) THEN 1160
1100 N=N+1
1110 T$=A$(I)
1120 A$(I)=A$(L)
1130 A$(L)=T$
1140 I=I-M
1150 IF I>=1 THEN 1070
1160 J=J+1
1170 IF J>K THEN 1020
1180 GOTO 1060
1190 FOR I=1 TO Y
1200 PRINT A$(I)
1210 NEXT I
1220 GOTO 40
1230 END
```

Program Run

```
:70 DIM A$(11)
:RUN
ALPHABETIZE

(TO END PROGRAM ENTER 0)
NUMBER OF ITEMS? 11
ITEM 1 ? WILSON ROBERT
ITEM 2 ? JAMES SUSAN W.
ITEM 3 ? SMITH KENT
ITEM 4 ? MITCHELL MICHAEL
ITEM 5 ? MCGOWAN ANN T.
ITEM 6 ? LEE ALEXANDER II
ITEM 7 ? MITCHELL MARY
ITEM 8 ? BOWERS DAVID
ITEM 9 ? EVANS STEVEN
ITEM 10 ? JAMESON CAROL
ITEM 11 ? NORTH LINDA


 BOWERS DAVID
 EVANS STEVEN
 JAMES SUSAN W.
 JAMESON CAROL
 LEE ALEXANDER II
 MCGOWAN ANN T.
 MITCHELL MARY
 MITCHELL MICHAEL
 NORTH LINDA
 SMITH KENT
 WILSON ROBERT

 NUMBER OF ITEMS? 0

 END PROGRAM
```

Day of the Week

The following program calculates the day of week a given date falls on. For example, it will figure that Christmas, 1980, will be on a Thursday.

The date you're interested in must be entered in numeric form and in order of month, day, year. September 12, 1975, would be entered as 9, 12, 1975. Make certain that commas, not slashes or dashes, separate the figures.

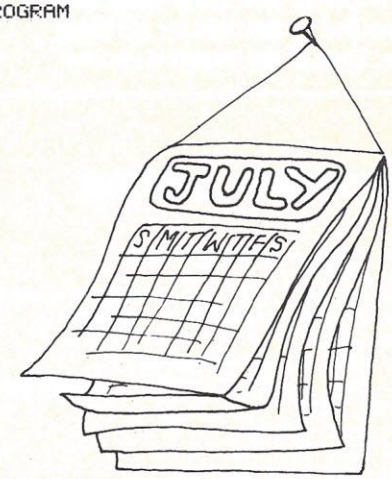
Here are a few examples to start you off: Cindy's birthdate is March 4, 1953. On what day was she born? Uncle Lon had an appointment on September 30, 1977. What day was that? □

Program Listing

```
10 PRINT "DAY OF THE WEEK"
20 PRINT
29 REM - REQUEST USER INPUT
30 PRINT "(ENTER 0,0,0 TO END PROGRAM)"
40 PRINT  "MONTH, DAY, YEAR";
50 INPUT M,D,Y
59 REM - TEST FOR END OF PROGRAM
60 IF M<>0 THEN 100
70 IF D<>0 THEN 100
80 IF Y<>0 THEN 100
90 GOTO 360
99 REM - NEED TO ADJUST INPUT FOR CALCULATIONS?
100 IF M>2 THEN 130
109 REM - ADJUST INPUT
110 M=M+12
120 Y=Y-1
129 REM - CALCULATE DAY NUMBER
130 N=D+2*M+INT(.6*(M+1))+Y+INT(Y/4)-
    INT(Y/100)+INT(Y/400)+2
140 N=INT((N/7-INT(N/7))*7+.5)
149 REM - FIND CORRECT DAY NUMBER,
    TRANSLATE TO DAY, PRINT
150 IF N>0 THEN 180
160 PRINT "SATURDAY"
170 GOTO 340
180 IF N>1 THEN 210
190 PRINT "SUNDAY"
200 GOTO 340
210 IF N>2 THEN 240
220 PRINT "MONDAY"
230 GOTO 340
240 IF N>3 THEN 270
250 PRINT "TUESDAY"
260 GOTO 340
270 IF N>4 THEN 300
280 PRINT "WEDNESDAY"
290 GOTO 340
300 IF N>5 THEN 330
310 PRINT "THURSDAY"
320 GOTO 340
330 PRINT "FRIDAY"
340 PRINT
349 REM - RESTART PROGRAM
350 GOTO 40
360 END
```

Program Run

```
(ENTER 0,0,0 TO END PROGRAM)
MONTH, DAY, YEAR? 3,4,1353
WEDNESDAY

MONTH, DAY, YEAR? 9,30,1977
FRIDAY

MONTH, DAY, YEAR? 0,0,0

END PROGRAM
```



Sponsored "Programs" are Coming

BY WILLIAM R. PARKS

The seeds for developments in the microcomputer field have already been planted. What happens to home computers in the future is already happening, or has taken place, in the field of large scale data processing.

The main source of predictions in home computing can be traced to the availability of "state-of-the-art" systems. Such equipment can be purchased from well-known companies today. In other words, what is expensive today might in a few years be inexpensive and common-place. For the first time, since the dawn of electronic computers, we can now bring the awesome power of these devices into the kitchen, the living room, or the basement study.

Another promising fountainhead in the future of microcomputing is the current progress in research laboratories. Also, whatever new theories appear in journals, even the most scholarly, are sure to have some eventual effect on software and hardware components of home computers.

When I consider recent developments of the microcomputer industry, I become aware of the cohesion in the entire computer society. There is no isolated world of data processing that is really detached from home-life. The age of computing in the home has arrived. In this series of articles which will appear from time to time, we will discuss the future function of the microcomputer in the home.

I believe that the most important development will come in the field of communications.

I am intrigued by the fact that programs and data can be stored on ordinary audio cassette tapes. Such a concept of program "taping" suggests a natural comparison to the universal popularity of audio cassette tapes. Those tapes are used primarily to record music and are sold throughout the country in a multitude of record shops. The success of this facet of the record industry should, I believe, cause another industry to develop with best-selling programs — and even gold cassette awards for one million selling programs!

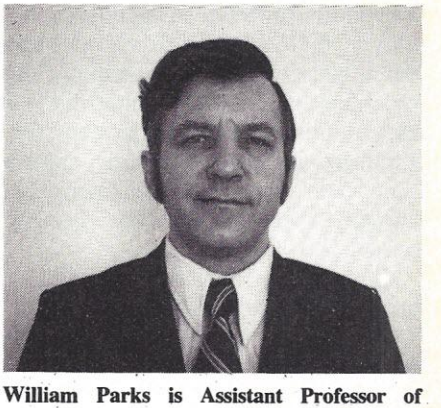
However, I think that the most important impact of this new cassette market will be to force microcomputer manufacturers to accommodate buyers with audible-sound storage and audible input-output components. What I mean is that existing hardware, such as home tape recorders are going to be used for picking up programs. There is no reason why FM stations can't broadcast programs such as recipes for home cooking, games for home play, and educational courses for home study. And a most exciting aspect of this transmission would be the possibility of sponsorship by business, just as is now done in television and radio.

Imagine how this latter idea would work. You turn to a "digital" FM broadcast station, hook up your tape recorder (or microcomputer system input jack), and bingo! — for five minutes you receive a program sponsored by a soft-drink company. After dubbing the transmitted program onto your tape, you run it on your microcomputer. The first thing that happens, obviously, is an advertisement about an exciting new carbonated beverage. After about a minute of this, you get to interact or play with a series of computer programs never before broadcast anywhere. The material you have just captured from the airways is truly original stuff that is entertaining or educational.

The reason for originality in the programs being transmitted is to insure that persons with home computers will "listen in". The reason why a soft-drink company would sponsor the digital broadcast would be to get their advertising **permanently imbedded in the program.** The commercial message would be a constant reminder to players of the program that it was the soft-drink companies that sponsored this new original program for them and they'd better run out and get a case of the new flavors. If a company paid just $100,000 for such a program, the incentive could produce some very fine software applications for home entertainment and/or education.

I, therefore, foresee the inevitable development of entertainment software houses for the FM digital radio networks. Eventually, all TV sets would have tape recorders built into them for hard copy transmission of recipes, educational programs, etc. along with the video portion advertisements for simple graphic display. Needless to say, a "**standard**" audible tone and storage method would have to be adopted nation-wide before such a digital broadcasting network could become effective. However, in some regions of the country there are already enough Radio Shack TRS-80s up and running to justify broadcasting computer programs on a weekly basis — sponsored, perhaps, by local computer stores.

Some FM bands are already being used in industry to transmit data. I believe it is only a matter of time before nationally known businesses will be sponsoring such broadcasts.



William Parks is Assistant Professor of Information Systems Management, Buffalo State College, Buffalo, NY.

π in the Computer Age

People have been calculating the value of π for years. Even the digit hunters of Babylon in 200 B.C. know the fundamental constant was about 3-1/8. But it wasn't until the dawn of the computer age that π could be calculated to hundreds of thousands of decimal places.

BY PETR BECKMANN

The story of π in the computer age of the 20th century is reminiscent of that of the digit hunters in the 18th and 19th centuries. The main difference is that where the digit hunters of the 18th and 19th centuries topped the standing records by tens and hundreds of decimal places, the computers and their programmers topped the standing records by thousands, and then by hundreds of thousands of digits. By 1967, the value of π was known to 500,000 decimal places. And, of course, where the digit hunters had drudged for months and years to find hundreds of decimal places, the computer that churned out half a million digits needed only 26 hours and 40 minutes (plus 1 hour and 30 minutes to convert the final result from binary to decimal notation). The similarity between the *idiots savants* of the 18th and 19th centuries and the imbecility of the 20th century computer has already been pointed out. Yet as we come to the end of the story, this simlarity vanishes; for we are living at a time when some computers (more accurately, their programs) have become remarkably intelligent.

Before we take a look at these lately arrived intelligent computers, we return to their older, moronic brother, who is not capable of anything but slavishly following comparatively simple commands of its programmer, albeit with enormous speed and the use of its vast memory. It was this kind of computer that was used to rattle off the decimal digits of π.

The first computer calculation of π was apparently made in September 1949 on ENIAC (Electronic Numerical Integrator and Computer) at the Ballistic Research Labs; it calculated π to 2,037 places in 70 hours, a pitifully long time by today's standards. Like many other computer evaluations, this one was programmed in accordance with Machin's formula in the form:

$$\pi = 16 \arctan (1/5) - 4 \arctan (1/239)$$

In November 1954 and January 1955, NORC (Naval Ordnance Research Calculator) at Dahlgren, Virginia, was programmed to compute π to 3,089 significant places; the run took only 13 minutes.

This record was broken at the Ferranti Computer Centre, London, in March 1957, when a Pegasus computer computed 10,021 decimal places in 33 hours. However, a subsequent check revealed that a machine error had occurred, so that "only" 7,480 decimal places were correct. The run was therefore repeated in March 1958, but the correction was not published.

Then, in July 1958, an IBM 704 at the Paris Data Processing Center was programmed according to a combination of Machin's formula and the Gregory series; it yielded 10,000 decimal places in 1 hour and 40 minutes.

A year later, in July 1959, the same program was used on an IBM 704 at the Commissariat a l'Energie Atomique in Paris, and 16,167 places were obtained in 4.3 hours.

Machin's formula was also the basis of a program run on an IBM 7090 at the London Data Centre in July 1961, which resulted in 20,000 decimal places and required only 39 minutes running time.

By this time the limit of the then available computer memories had almost been reached. Further substantial increases in the number of decimal places could have been obtained only by modifying the programs to use more machine time and therefore to run into unreasonable costs.

But in July 1961, Shanks and Wrench increased the speed of the computation by a factor of about 20. (Daniel Shanks, incidentally, is not related to William Shanks, who calculated 707 places just 100 years ago). In part, this was due to a faster computer (an IBM 7090 at the IBM Data Processing Center, New York), but they also used several tricks in programming it; in particular, they abandoned Machin's formula in favor of the formula:

$$\pi = 24 \arctan (1/8) + 8 \arctan (1/57) + 4 \arctan (1/239)$$

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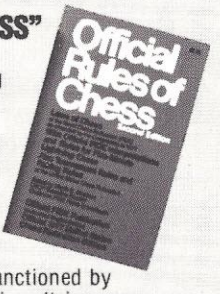

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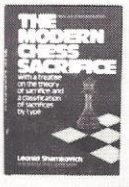

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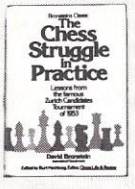

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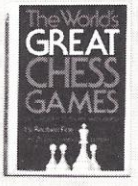

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which was found by Stormer in 1896. The run resulted in 100,265 decimal places, of which the first 100,000 were published by photographically reproducing the print-out with 5,000 decimals per page. The time required for computing the first term was 2 hours and 34 minutes, for the second term 3 hours and 7 minutes, and for the third term 2 hours and 20 minutes. To this must be added 42 minutes for converting the final result from binary to decimal digits, so that the total time required was 8 hours and 43 minutes.

A computation of this kind involves billions of individual arithmetic operations, and if a single one of these is mistaken, the entire subsequent operation may yield an erroneous result. It is therefore necessary to check the result. For this, Shanks and Wrench used a special method which calculates π by a different formula (another arctanget formula, due to Gauss), but uses the partial results of the original run in such a way that the check takes less time than the original computation.

Subsequently, π was computed to 250,000 decimal places on an IBM 7030 at the Commissariat a l'Energie Atomique in Paris in February 1966, and a year later, in February 1967, a CDC 6600 was programmed by J. Gilloud and M. Dichampt, at the same institution, to yield 500,000 decimal places. The program was again based on Stormer's formula and the Shanks-Wrench method for checking the digits; the running time was 28 hours and 10 minutes (of which 1 hour and 35 minutes were used for conversion), and an additional 16 hours and 35 minutes were needed for the check. These quarter- and half-million digit values of π were published in reports of the Commissariat a l'Energie Atomique in Paris.

This, as far as I know, is the present record. I may be mistaken, and even if I am not, this record will, no doubt, eventually be broken.

The driving force behind these computations seems to be, at least in part, the same as the one that drove Ludolf van Ceulen to find the first 20 decimal places in 1596. Yet these hundreds of thousands of digits are not quite as useless as the results of the earlier digit hunters. There are two reasons for this. The first, admittedly, is not very convincing. It concerns the statistical distribution of the digits, which is expected to be uniform, that is, the frequency with which the digits (0 to 9) appear in the result will tend to the same limit (1/10) as the number of decimal places increases beyond all bounds. An analysis of the first 16,000 decimal digits bears this out within the usual statistical tests, but this does not constitute a rigorous proof for a finite number of digits, no matter how large; on the other hand, a rigorous theoretical proof (which has not yet been given) has no need of the actual arithmetical computation. And as for the generation of digits with equal probabilities, this can be done in much simpler ways.

The other reason for such computations is more convincing. Before it goes into operation, a computer, like any other machine, is tested whether it can do its job reliably. One such method is to let it churn out a few tens of thousands of decimal digits of π and to check the result against the known figures; if they agree, the computer has performed millions of arithmetical operations faultlessly. (There are, of course, other functions that must also be tested.)

These hundreds of thousands of digits are not quite as useless as you might imagine.

All of the computations above were performed by computers with not an ounce of intelligence. The frustration resulting from the computer's inability to insert a simple program to make the computer supply the missing dot and to print, for example, the following comment:

LOOK BUDDY, I PUT IN A DOT FOR YOU IN LINE 123, BUT NEXT TIME DO IT YOURSELF, OK?

But this does not, of course, constitute intelligence. Every step to produce this result must be covered by the instructions that make a computer execute a program, and the above sentence must be, so to speak, put into the computer's mouth by the programmer. That is not the way one gives instructions to an intelligent being. If you ask your wife (or husband) to bring you a glass of water, you don't instruct her (or him) exactly what muscle to move at any given time. She (he) will, without specific instructions, turn on the cold, not the hot, water, and will use judgement in unexpected situations — if for some reason no glasses are available, she (he) will overrule your instructions and bring you a cup, even though you asked for a glass. That does not take much intelligence, but it is a lot more than most contemporary computers have.

Will computers ever become intelligent?

They already have. Not the morons that bill your charge account or that compute the decimal places of π, but the amazing programs (it is the programs rather than the actual computer hardware) that have been growing in the last few years at Stanford, M.I.T., John Hopkins and other laboratories.

Intelligence, says my dictionary, is "the ability to adapt to new situations, and to learn from experience; the inherent ability to seize the essential factors of a complex matter."

Believe it or not, but there is nothing in that definition that a machine cannot be programmed to do. Programs have been written that learn from experience, adapt to new conditions, grasp the essentials of a complicated problem, and decide for themselves how to solve it; and all that (as yet in a few very restricted areas) with an intelligence that approaches that of the best humans in the field, and far surpasses the intelligence of most others. The stress here is on how *well* they can do this, not on how many varied problems they can manage, for the memory of a computer and the access to it cannot (yet) compete with the human brain. But the qualitative principle is there.

Take, for example, the program that plays checkers, as developed over the years since 1947 by Arthur Samuel. This program will learn from experience (Samuel improved it by making several computers play checkers furiously against each other for prolonged periods). It can also learn from other players' experience, and it will "study" other people's games and moves recommended by champions. In a given position, it will not slavishly go through all the possible moves and their consequences (there are too many), but it will use certain criteria to evaluate its own position and to determine the best strategy, and it will then make its own decision as to the next move. The re-

sults: Although the program could not beat the world checkers champion, it did beat the champion of Connecticut, it would probably beat you, it would certainly beat me, and — an extremely significant fact — *it beats its own programmer*.

There are many other examples: programs to play other games (including chess) intelligently; programs that will prove theorems (one such program proved, in its initial version, 38 out of the first 52 theorems in Newton's *Principia*); programs that verify mathematical proofs and expose fallacies; programs that solve general problems to attain given goals; and many others, including one with great potentialities — a program to write programs. A computer that is particularly dramatic, though perhaps less sophisticated than others in this class, is The Beast, a battery-operated cylinder on wheels built by scientists at the Applied Physics Lab of Johns Hopkins University. It has its own computer logic and steering, and it is furnished with tactile, optical and sonar sensors. The Beast was often let loose to roam the halls and offices of the Applied Physics Lab, which it would do without bumping into walls or falling downstairs (it would turn round on sensing a step), and when its batteries were low, The Beast would optically find an outlet in some office, plug itself in, and depart again when it had "eaten," no doubt often leaving behind a new secretary frozen in horrified incredulity.

But let us return to the checkers program that can beat its own programmer. A long time ago, even when he constructed his first bow and arrow, man used his intelligence to design machines that surpassed him in speed, force and many other qualities. Arthur Samuel's program might be taken as a historic landmark: Somewhere near that point, man first used his intelligence to design a machine that surpassed him in intelligence. We're now only at the birth of such a machine but eventually the intelligent computer might be to the moronic computer as the spacecraft is the the bow and arrow. There are already programs to write programs, and progams to balance assembly lines. It is therefore entirely within the realm of possibility that such a machine will eventually have the ability to reproduce itself.

"Destroy it!" is what the pious, respectable and community-minded ladies will scream when word gets out about the new computer.

Their screams have been heard before.

"Destroy it!" is what Julius Caesar screamed as his hordes put the torch to the Library of Alexandria.

"Destroy it!" is what the Grand Inquisitor screamed when he read Galileo's *Dialogues*.

"Destroy it!" is what the Luddites screamed in 18th-century England when they smashed the machinery that was supposedly responsible for their misery in the Industrial Revolution.

"Destroy it!" is what the Soviet censor screams when he sees a copy of Orwell's *1984*.

"Destroy it!" is what the Fascists of the Left screamed when they bombed or smashed computing centers in Minnesota or Montreal.

It has again become fashionable to blame science and technology for the ills of society. I have some sympathies for the Luddites who were uneducated, miserable and desperate. I have none for the college-educated illiterates who drivel about "too much science and technology" because they want to conserve their life style by denying it to everybody else.

Three centuries ago, Gottfried Wilhelm Leibniz, co-inventor of the calculus and co-discoverer of the first infinite series for π, dreamt of the day when courts would be abolished, because disputes would be settled mathematically by solving impartial equations that would show who was right and who was wrong. The intelligent computer that is now being born makes the dream somewhat less fantastic. Perhaps the *n*th generation of intelligent computers will make a better job of keeping peace among men and nations than men have ever been able to.

And with that thought our story of π is coming to an end. It is a story as varied as the brilliance of Archimedes of Syracuse and the ignorance of Heisel of Cleveland.

The history of π is only a small part of the history of mathematics, which itself is but a mirror of the history of man. That history is full of patterns and tendencies whose frequency and similarity is too striking to be dismissed as accidental. Like the laws of quantum mechanics, and in the final analysis, of all nature, the laws of history are evidently statistical in character.

But what those laws are, nobody knows. Only a few scraps are evident. And one of these is that the Heisels of Cleveland are more numerous than the Archimedes of Syracuse. □

A Program To Register More Than Cash

This program, Cash Register, allows small businesses to keep records of all sales, both to cash customers and to those with established accounts. For each transaction, the program records items, quantities, prices, taxes and amount paid. At the month's end, the program provides detailed statements for each account.

The basic unit of information is the transaction, which can contain up to four different items. Each item's description, unit price and quantity are stored. Also recorded are tax paid, ship-to state (if any) and how much the customer paid at the time of sale.

The program produces printed invoices for the customer, and two back-up copies for the business.

The following descriptions detail each part of the program (keyed to the flowcharts):

1. Open a new account. This function inputs all data pertaining to a new, permanent account. Presumably, a credit rating has been performed; and the company gives normal credit standing (net in 30 days) to its list of permanent accounts.

After being input, data is typed back by the program for verification. Any incorrect item must be re-entered. When satisfied with the accuracy of the information, the user stores the account description in the account file on disk. The program automatically provides a number for each account as it is entered.

Normally, you'll set up one account called Cash. This account represents all cash transactions — those transactions with customers not on your permanent list.

2. Enter a transaction. This function first requests data for the transaction. Transactions are organized on disk into separate files by month. The correct file is opened and the first vacant sector located.

Then the account number is input and verified by checking the account's printed description. If this is a cash account, the customer's name and address must be entered.

Next, you may enter up to four different items, with the description, quantity and unit price for each item. Tax rate and ship-to state (if any) are also entered.

Next, the invoice is printed, along with a request for the total amount the customer is paying at the time of the transaction.

You should check the entire invoice for errors and make corections if necessary. Then give the corrected invoice to the customer, who pays the amount stated. The program prints two office copies and stores the transaction on disk.

3. List a month's transactions. Input which month to list and the program types out all transactions for that month.

4. Kill a transaction. This function deletes a single transaction. Use it whenever an error occurs but is not discovered until after the invoice is printed and given to the customer. Kill the original transaction before writing the new one.

The function first requests the desired transaction's month. The transaction number is then input. If known, that transaction is displayed, and the user confirms that this transaction will be killed.

If the transaction number is unknown, the account number is entered and its transactions displayed until the proper transaction is printed.

Disk space of killed transactions becomes free for use by the next transaction.

5. Kill a month. You can erase an entire month's records — for example, when the disk fills up or when a new year's transactions replace the previous year's.

6. Account status for a month. This function produces detailed monthly statements for any account. After the month and account are input, the transactions are printed, followed by monthly subtotals of merchandise, tax, grand total and total paid.

7. All account totals for a month. After you input the desired month, the program prints a chart showing subtotals of each account for that month.

8. List all accounts. This function prints descriptions of all established accounts, including account numbers.

BY SAM NEWHOUSE

Program Notes

I first wrote on a single sheet of paper the various functions I wanted, along with simple descriptions of each. These functions were then simplified, combined and in some cases eliminated.

Next I drew rough flowcharts for each function. In writing these, several routines appeared over and over. So I saved space in the final program by modifying these routines for use by all parts of the program. Also, structures of the acount and transaction files were established.

Working with flowcharts, I wrote and debugged each major function and subroutine, one at a time.

After I had a functioning but no-frills program, I improved the graphics display of information to make everything more readable. Then I carefully checked the program with test data. (One error popped out. I had forgotten to zero a matrix, so the first customer's subtotal was correct but all subsequent customers' subtotals were highly inflated.)

Finally, I re-flowcharted the program, working directly from the code listing. A good tool for this purpose was an IBM flowcharting template, well worth the 35-cent cost.

The Cash Register program, written in Mits Disk Extended BASIC V 3.4, takes 12,400 bytes of memory space. As written, it needs one disk and a printing terminal. The program uses random disk files exclusively.

Random disk files are called "random" because any record, or unit of information, can be retrieved or written just as quickly as any other record. Unlike serial files, any record can be modified without changing anything else in the file.

Mits Disk Extended BASIC requires several disk-related commands used with random disk files. They are:

- **OPEN** — readies a named file for input/output.
- **CLOSE** — closes a file and keeps any changes made while it was open.
- **FIELD** — specifies the way the 128-byte length of each random record is broken up. It specifies how many bytes are allocated to each item of information of a record. Execute the field statement prior to any "get" or "put".
- **GET** — retrieves the contents of a specified random record. Each variable in the preceding field statement is assigned the value specified in the retrieved record.
- **LSET** — assigns a value to one of the FIELDed variables prior to PUTing information onto the disk.
- **PUT** — writes the current value of each FIELDed variable onto the specified random sector.
- **LOF** — tells the program whether the end of a random file has been reached.
- **CVS** — converts a number to a 4-byte string for disk storage.
- **MKS** — converts a 4-byte string back to a number

Other commands are standard and should conform to any BASIC. One exception exists. With Mits BASIC, if you type "return" with no value preceding it in response to an input request from the program, the prior value of the variable being input remains in effect. In some BASICs, typing "return" to an input request stops the program and prints an error message. (Apple, for example, does this.)

File Structure

TRANSACTION FILE

Valid?	1 byte
Date	12 bytes
Account #	4 bytes
Description #1-4	15 bytes each
Quantity #1-4	4 bytes each
Price #1-4	4 bytes each
Tax Rate	4 bytes
Ship-to State	2 bytes
Amount Paid	4 bytes

ACCOUNT FILE

Name	20 bytes
Address	20 bytes
City/State	20 bytes
Zip Code	5 bytes
Attention - To	20 bytes
Phone #	10 bytes
Tax Exempt #	10 bytes

Sample Run Notes

Put together a list of names and addresses of your established-account customers. Using the New Account function, type in and verify each account description, one at a time. The beginning of the sample run shows accounts being entered. Next, list all your accounts with the List function.

With your customer list complete, begin to generate and store invoices/transactions using the Transaction function. This function first asks for the transaction date, which should be entered: MM/DD/YY. Next, enter the account number. You can find the account number easily on the newly printed list of accounts.

Specify whether this is a cash account. If so, the name, address and other purchaser information must be entered. Then enter the tax rate as .08, .07 or so on. If the merchandise will be shipped out-of-state, enter the two-letter abbreviation of its destination state.

Now you are ready to input the actual items being purchased. A maximum of four items may be put on one invoice. For each item, type in its description (up to 15 characters), unit price and quantity.

Next, an invoice is printed, including a grand total. When requested, enter the amount paid. The customer may pay in full, partially or not at all (and be billed at the end of the month).

Enter the amount the customer pays at the time. Check the invoice carefully. If it is correct, answer "yes" to the query: "Is invoice correct?"

It's not necessary to retype the name/address part of the invoice if there are no errors in it. Simply type "return" to each question where the previous information was correct.

However, the description of each item, price and quantity *must* be reentered if there are *any* mistakes.

With each invoice printed, two office copies are also printed. Place one office copy in the Account's file in a file cabinet, and the other copy in a back-up file.

At the end of the month, you will want to print out detailed monthly statements for each account. The AS program function provides the account status. (See the Sample Run.) First input the account number, then the month desired in the form: "MM/". Omit leading zeros in months.

The detailed statement prints copies of all transactions, followed by the accounts' totals for the month: total merchandise, total tax, grand total and total paid. The account's balance is grand total minus total paid.

Sometimes, you may want to know the totals of all accounts for a particular month. All accounts with any transactions in the month selected will be listed.

The function called AT (for All Totals) lists the account number, merchandise, tax, grand total and total paid for all accounts.

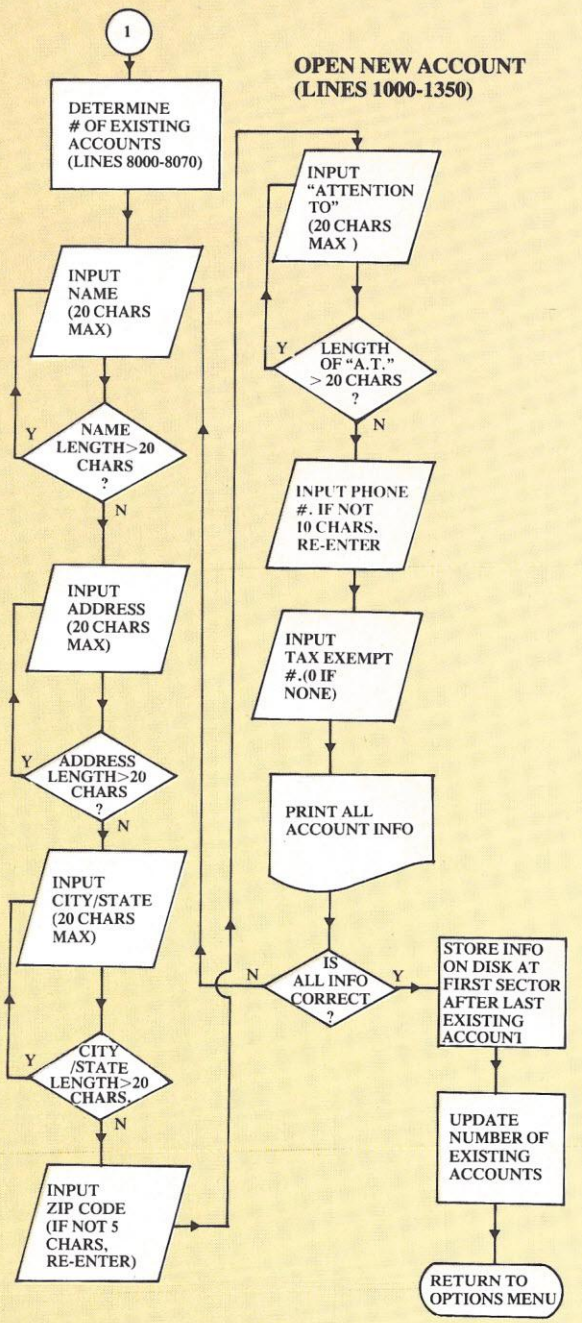
Another function, KT, kills a transaction. For many reasons, you might want to eliminate a transaction. For example, to make a change, you must kill the old transaction to avoid having duplicate records.

This function asks for the transaction month of the kill. Use the format "MM/" without leading zeros. If the transaction number is known, enter it and that transaction will be displayed. Otherwise, type "return" and enter the account number of the customer involved. All the transactions of that customer in the month selected will be displayed until you find the proper one. At this point, confirm that this transaction is to be killed. (See Sample Run for example.) Note that in Transaction 3, Account #1 is killed.)

The Sample Run shows a new chart of all accounts' totals. Notice that Account #1's totals are all reduced because of the transaction just killed.

The last function of the programs is KM for kill a month. This function simply deletes an entire month of transactions.

Just to confirm the month was killed, I asked for the list of transactions for April on the Sample Run. □



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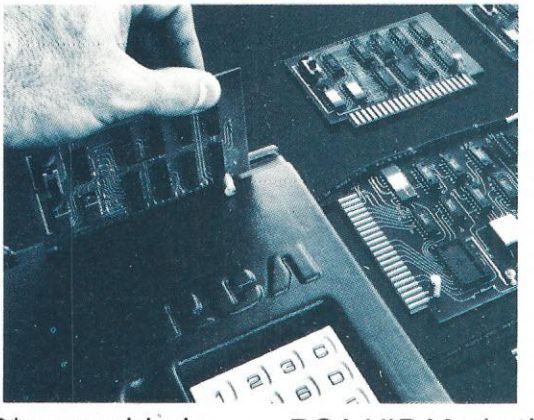

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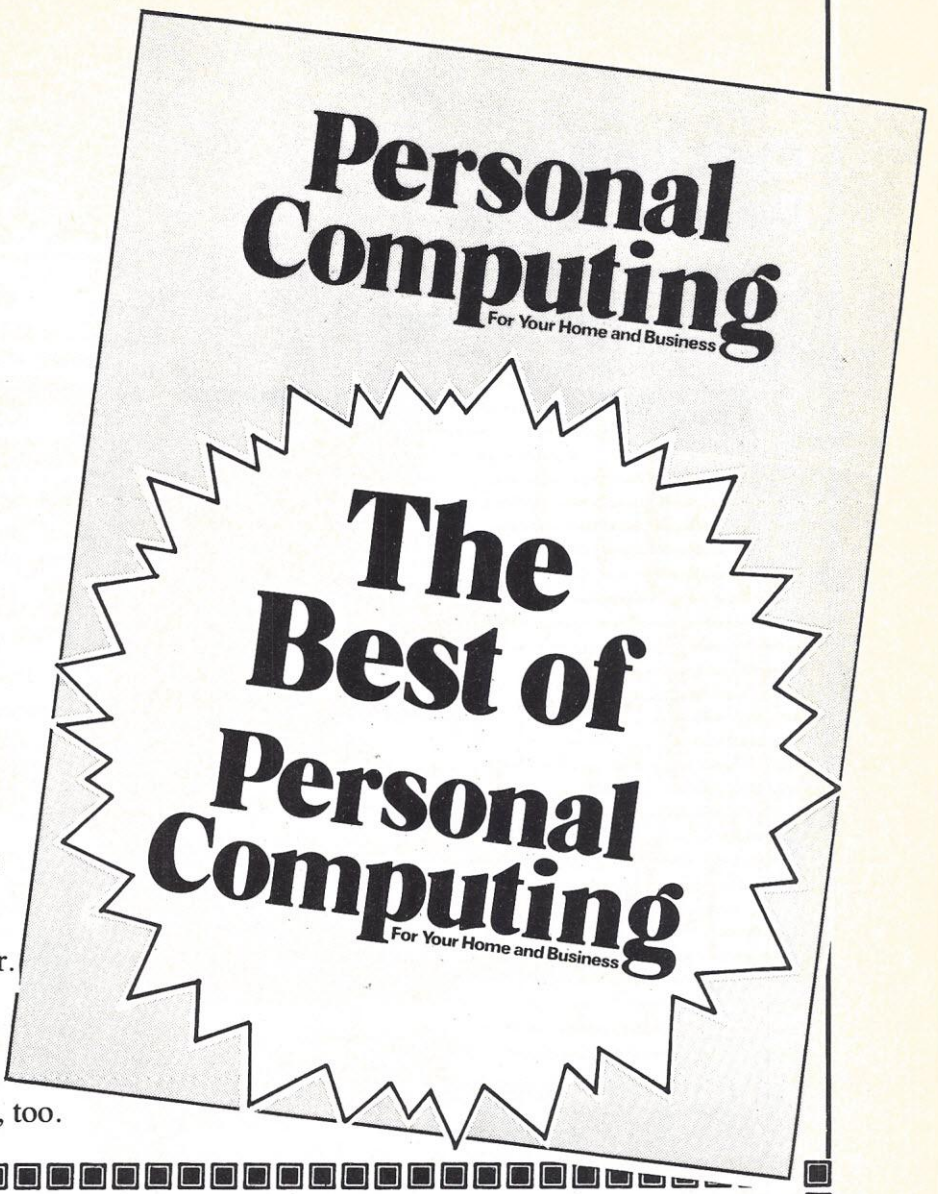

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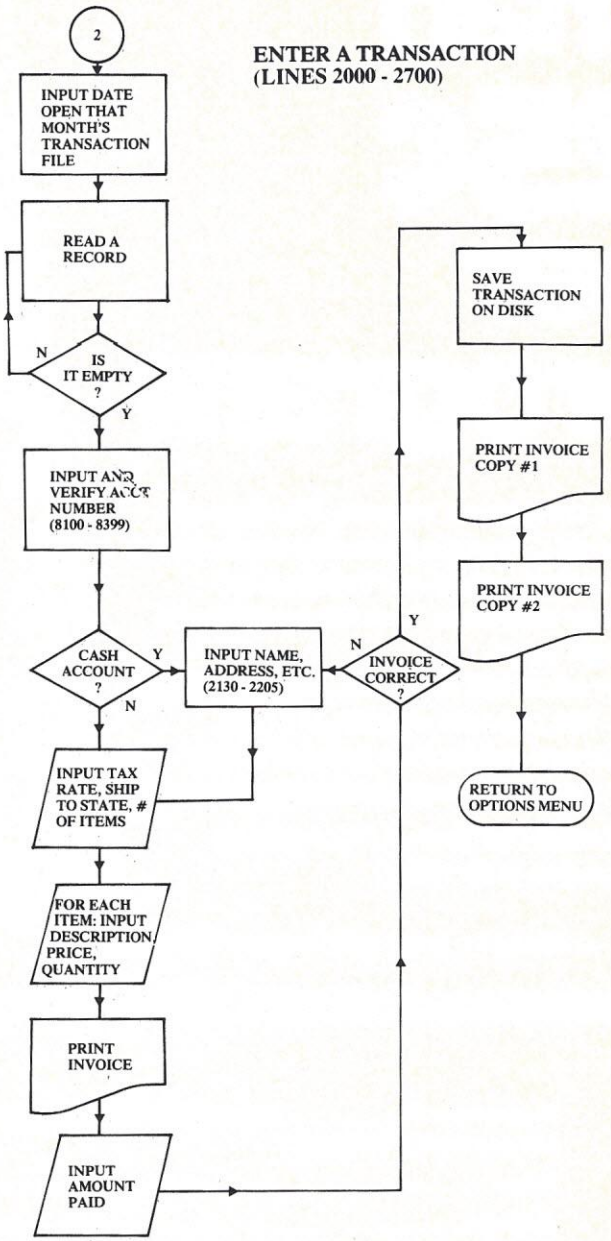
Cash Register Program Listing

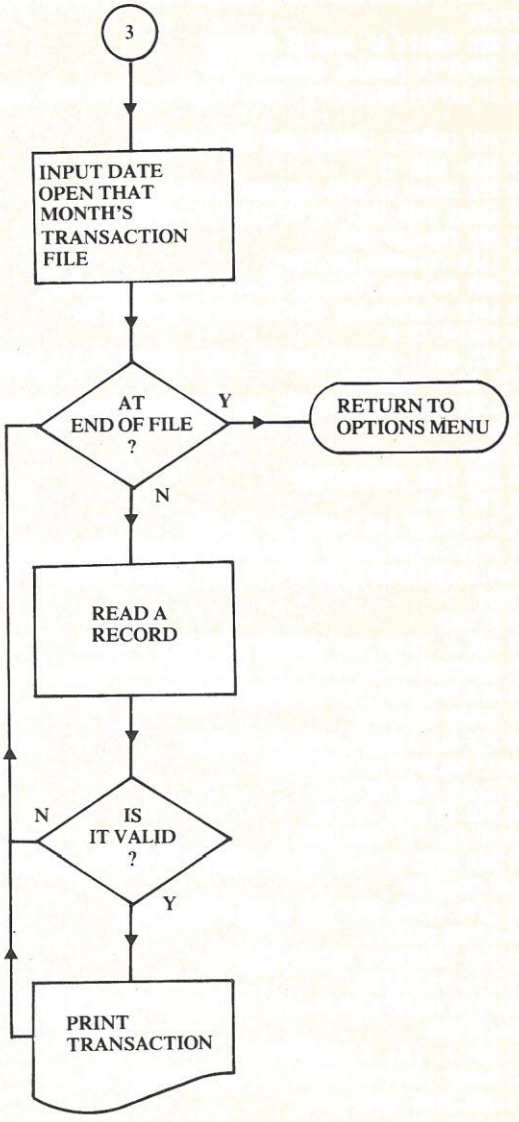
```
1 REM TRANSACTION RECORDER (CASH)
2 REM BY SAM NEWHOUSE
3 REM COPYRIGHT (C) 1978 BY SAM NEWHOUSE
4 CLEAR 5000:WIDTH 80
5 DIM TP(200),TT(200),TX(200)
10 CC$="*":PRINTCHR$(16);CHR$(22);:PRINT:INPUT "COMMAND";CC$
20 IF CC$="AC" THEN GOSUB 1000:GOTO10
30 IF CC$="LI" THEN GOSUB 9500:GOTO10
40 IF CC$="TR" THEN GOSUB 2000:GOTO10
55 IF CC$="KT" THEN GOSUB 4000:GOTO10
60 IF CC$="MT" THEN GOSUB 3000:GOTO10
65 IF CC$="AT" THEN GOSUB 7400:GOTO 10
75 IF CC$="KM" THEN GOSUB 5000:GOTO10
85 IF CC$="AS" THEN GOSUB 6000:GOTO10
100 PRINT"1. NEW ACCOUNT(AC)"
110 PRINT"2. TRANSACTION (TR)"
120 PRINT"3. MONTH'S TRANSACTIONS (MT)"
130 PRINT"4. KILL A TRANSACTION (KT)"
140 PRINT"5. KILL A MONTH (KM)"
150 PRINT"6. ACCOUNT STATUS FOR A MONTH (AS)"
170 PRINT"7. ALL TOTALS FOR A MONTH (AT)"
180 PRINT"8. LIST OF ACCOUNTS (LI)"
190 INPUT"OPTION #";C
200 IF C<1 OR C>8 THEN PRINT"USE OPTION #'S FROM 1 TO 8.";CH
R$(7):GOTO100
210 ON C GOSUB 1000,2000,3000,4000,5000,6000,7400,9500
220 GOTO 10
1000 REM 1. OPEN NEW ACCOUNT
1010 REM OPEN ACCT FILE- GET # OF ACCTS
1020 GOSUB 8000
1025 PRINTCHR$(16);CHR$(22):PRINT
1027 PRINT"***  ENTER NEW PERMANENT ACCOUNT ***":PRINT:PRINT
"******************************"
1030 PRINT"ACCOUNT #";A9+1:A9=A9+1
1040 REM INPUT DATA
1050 INPUT"NAME (20 CHARACTERS)";N1$
1060 IF LEN(N1$)>20 THEN PRINT"NAME TOO LONG.";CHR$(7):GOTO1
050
1070 INPUT"ADDRESS (20 CHARACTERS)";N2$
1080 IF LEN(N2$)>20 THEN PRINT"ADDRESS TOO LONG.";CHR$(7):GO
TO1070
1090 PRINT"CITY/STATE (20 CHARACTERS) ?";:LINE INPUT N3$
1100 IF LEN(N3$)>20 THEN PRINT"CITY/STATE TOO LONG.";CHR$(7)
:GOTO1090
1110 INPUT"ZIP CODE";N4$:IF LEN(N4$)<>5 THEN PRINT"INVALID Z
IP CODE.";CHR$(7):GOTO1110
1120 INPUT"ATTENTION TO: (20 CHARACTERS)";N5$
1130 IF LEN(N5$)>20 THEN PRINT"ATTENTION TO TOO LONG.";CHR$(
7):GOTO1120
1140 INPUT"PHONE # (10 CHARACTERS)";N6$
1150 IF LEN(N6$)<>10 THEN PRINT"INVALID PHONE #.";CHR$(7):GO
TO1140
1160 INPUT"TAX EXEMPT # (0 IF NONE)";N7$
1170 PRINT:PRINT
1175 REM TYPE BACK ACCT INFO FOR VERIFICATION
1180 PRINT"ACCOUNT #";TAB(15);A9
1190 PRINT"NAME";TAB(15);N1$
1200 PRINT"ADDRESS";TAB(15);N2$
1210 PRINT"CITY/STATE";TAB(15);N3$
1220 PRINT"ZIP CODE";TAB(20);N4$
1230 PRINT"ATTN:";TAB(15);N5$
1240 PRINT"PHONE #";TAB(15);:PH$=N6$:GOSUB 10500
```




```
1250 IF VAL(N7$)<>0 THEN PRINT"TAX EXEMPT #";TAB(15);N7$
1260 REM IS ABOVE INFO CORRECT?
1270 PRINT:PRINT:INPUT"CORRECT";YN$
1280 IF LEFT$(YN$,1)="Y" THEN 1300
1290 PRINT"ENTER CORRECT INFO. IF PREVIOUS INFO WAS CORRECT,
 TYPE 'RETURN' TO THAT ITEM.":GOTO 1050
1300 GOSUB 9000:REM FIELD STATEMENT FOR ACCT FILE
1305 REM N$=NAME,AD$=ADDRESS,CS$=CITY/STATE,Z$=ZIP CODE,AT$=
ATTENTION TO,PH$=PHONE NUMBER,TX$=TAX EXEMPT #
```

```
1310 LSET N$=N1$:LSET AD$=N2$:LSET CS$=N3$:LSET Z$=N4$:LSET
AT$=N5$:LSET PH$=N6$:LSET TX$=N7$:PUT #2, A9
1320 GOSUB 9010:REM NUMBER OF ACCOUNTS  FIELD STATEMENT
1325 REM STORE UPDATED NUMBER OF ACCOUNTS
1330 LSET NC$=STR$(A9)
1340 PUT #3,1
1345 PRINT"NEW PERMANENT ACCOUNT INFORMATION IS NOW STORED O
N DISK.":PRINT:PRINT"**********************************"
1350 CLOSE:RETURN
2000 REM 2. ENTER A TRANSACTION
2005 GOSUB 10300:PRINT"*** ENTER A TRANSACTION ***"
2010 REM OPEN CORRECT TRANS FILE
2020 GOSUB 8300
2030 REM TRANS FORMAT FIELD STATEMENT
2040 GOSUB 9020
2050 REM INITIALIZE SECTOR COUNTER
2060 S=1
2070 GOSUB 9020:GET #1,S:REM READ RECORD
2080 IF V$<>"U" THEN 2090:REM IS SECTOR EMPTY?
2085 S=S+1:GOTO 2070:REM NO-KEEP SEARCHING
2090 REM EMPTY SECTOR HAS BEEN FOUND
2100 REM INPUT AND VERIFY ACCT #
2110 GOSUB 8100
2120 REM INPUT INFO FOR INVOICE IF CASH ACCT OR IF ANY CHANG
ES
2125 INPUT"IS THIS A CASH ACCT.";YN$:IF LEFT$(YN$,1)="Y" THE
N 2130 ELSE 2215
2130 PRINTCHR$(16);CHR$(22):PRINT:PRINT"TYPE IN ACCOUNT INFO
:"
2150 PRINT:INPUT"NAME";N$
2160 INPUT"ADDRESS";AD$
2170 INPUT "CITY/STATE (NO COMMAS)";CS$
2180 INPUT"ZIP CODE";Z$
2190 INPUT"PHONE #";PH$
2200 INPUT"ATTENTION TO:";AT$
2205 INPUT"TAX EXEMPT # (0 IF NONE)";TX$
2215 INPUT"TAX RATE (0 IF EXEMPT)";P3$
2220 T4$="  ":INPUT"SHIP-TO STATE (TWO LETTERS, TYPE 'RETURN
' IF NONE)";T4$
2225 IF LEN(T4$)<>2 THEN PRINT"USE TWO LETTER STATE ABREVIAT
IONS.";CHR$(7):GOTO2220
2230 REM INPUT ITEMS
2235 FOR I=1 TO 4:P(I)=0:Q(I)=0:N1$(I)="":NEXT I
2240 INPUT"HOW MANY ITEMS (MAXIMUM OF 4)";IT
2250 IF IT <1 OR IT>4 THEN PRINT"PLEASE PUT 1 TO 4 ITEMS ON
EACH INVOICE.";CHR$(7):GOTO2240
2260 FORI=1TOIT
2270 PRINT"DESCRIPTION OF ITEM # ";I;" (15 CHARACTERS MAX.)"
2280 LINE INPUT N1$(I)
2290 IF LEN(N1$(I))>15 THEN PRINT"DESCRIPTION OF ITEM ";I;"
TOO LONG.";CHR$(7):GOTO2270
2300 PRINT"QUANTITY OF ITEM #";I;:INPUT Q(I)
2310 PRINT"UNIT PRICE OF ITEM #";I;:INPUT P(I)
2320 NEXT I
2325 REM FIGURE TOTAL MERCHANDRISE
2330 TT=P(1)*Q(1)+P(2)*Q(2)+P(3)*Q(3)+P(4)*Q(4)
2335 REM FIGURE TOTAL TAX
2340 TX=VAL(P3$)*TT
2345 REM FIGURE GRAND TOTAL
2350 GT=TT+TX
2360 REM PRINT TEST INVOICE
2369 PRINTCHR$(16);CHR$(22);
2370 PRINT:PRINT:GOSUB 10300
2375 PRINT:PRINT"DATE: ";DD$:PRINT
2378 PRINT"TRANSACTION #";S:PRINT"ACCOUNT #";A1:PRINT
2380 PRINT"SOLD BY:":PRINT"ABCD ELECTRONICS, 123 WEST EGG, N
.Y.C., N.Y."
```

LIST A MONTH'S TRANSACTIONS (LINES 3000-3300)

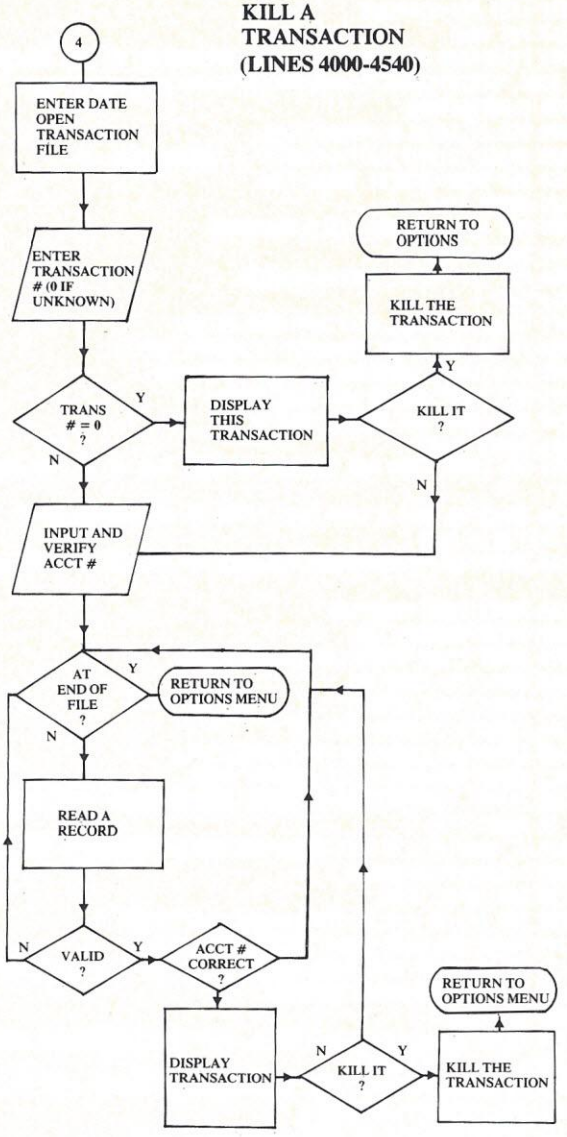



```
2390 PRINT:PRINT"BOUGHT BY:"
2400 PRINTN$:PRINTAD$:PRINTCS$:PRINTZ$:PRINT:PRINT"PH# ";:GO
SUB10500
2405 PRINT"ATTN:  ";AT$
2410 IF VAL(TX$)<>0 THEN PRINT"TAX EXEMPT # ";TX$
2420 IF T4$<>"  " THEN PRINT"SHIP TO:";T4$
2425 PRINT:PRINT:GOSUB10300
2428 REM PRINT ONE ITEM'S DESCRIPTION AND COSTS
2430 FOR I=1 TO IT: PRINT
```

Cash Register Program continued

```
2440 PRINT"QUANTITY- ";Q(I);"   PRICE-  ";P(I);"   ITEM- ";N
1$(I);"   EXT-  ";P(I)*Q(I)
2450 NEXT I
2460 PRINT:PRINT"TOTAL MERCHANDAISE: ";TT
2470 PRINT"TAX  :";TX
2480 PRINT"TOTAL:  ";GT
2490 PRINT:PRINT:PRINT:INPUT"AMOUNT PAID";T6:GOSUB 10300:PRI
NT:PRINT
2495 REM VERIFY IF INVOICE CORRECT
2500 INPUT"IS INVOICE CORRECT";YN$
2510 IF LEFT$(YN$,1)<>"Y" THEN PRINT"RE-ENTER INFO.":GOTO213
0
2520 REM CORRECT INVOICE HAS BEEN ENTERED
2530 REM- SAVE IT
2540 REM V$=VALID DATA INDICATOR;AC$=ACCOUNT #
2550 GOSUB 9020:LSET V$="V":LSET AC$=MKS$(A1)
2555 REM TR$=TAX RATE
2560 LSET TR$=MKS$(VAL(P3$))
2565 REM D$=DATE;ST$=SHIP-TO STATE;PD$=AMOUNT PAID
2590 LSET D$=DD$:LSET ST$=T4$:LSET PD$=MKS$(T6)
2600 FORI=1 TO 4
2605 REM N$(I)=DESCRIPTION OF ITEM I;P$(I) IS ITS UNIT PRICE
;Q$(I) IS IT QUANTITY
2610 LSET N$(I)=N1$(I):LSET P$(I)=MKS$(P(I)):LSET Q$(I)=MKS$
(Q(I))
2620 NEXT I
2625 REM SAVE TRANSACTION
2630 PUT #1,S
2635 REM PRINT TWO COPIES OF INVOICE
2640 PRINT:PRINT:GOSUB 10300:PRINT"OFFICE COPY #1":PRINT:GOS
UB8500:GOSUB10300:PRINT"OFFICE COPY #2":PRINT:GOSUB 8500:GOS
UB10300
2700 RETURN
3000 REM 3. PRINT ALL TRANSACTIONS FOR A MONTH
3005 GOSUB10300:PRINT"*** ALL MONTHLY TRANSACTIONS ***"
3010 REM OPEN CORRECT TRANSACTION FILE
3020 GOSUB 8300:S=1
3025 REM ALL TRANSACTIONS DISPLAYED?
3030 IF S=LOF(1)+1 THEN 3300
3040 GOSUB 9020:GET#1,S
3045 REM IS DATA VALID?
3050 IF V$()"V" THEN 3070
3055 REM WHEN LF FLAG IS SET, PRINTING ROUTINE DOES NOT PRIN
T NAME/ADDRESS
3060 LF=1:GOSUB 8500:REM PRINT TRANSACTION
3065 GOSUB 10300
3068 REM INCREMENT SECTOR COUNTER
3070 S=S+1:GOTO3030
3300 PRINT:PRINT"END OF LIST OF TRANSACTIONS.": GOSUB 10300:
CLOSE:RETURN
4000 REM 4. KILL A TRANSACTION
4005 GOSUB 10300:PRINT"*** KILL A TRANSACTION ***"
4010 REM OPEN TRANS FILE
4020 GOSUB 8300
4030 TI=0:INPUT"TRANSACTION # TO BE KILLED ('RETURN' IF UNKN
OWN)";TI
4035 REM IF TRANSACTION # IS KNOWN, DISPLAY THAT TRANSACTION
4040 IF TI()0 THEN 4500
4050 REM INPUT AND VERIFY ACCT # WHOSE TRANSACTION IS TO BE
KILLED
4060 GOSUB 8100:S=1
4065 REM AT END OF LIST OF TRANSACTIONS?
4070 IF S=LOF(1)+1 THEN 4200
4075 REM GET A TRANSACTION
4080 GOSUB 9020:GET #1,S
4085 REM IS DATA VALID?
4090 IF V$()"V" THEN S=S+1:GOTO4070
4091 REM IS ACCOUNT # CORRECT?
```

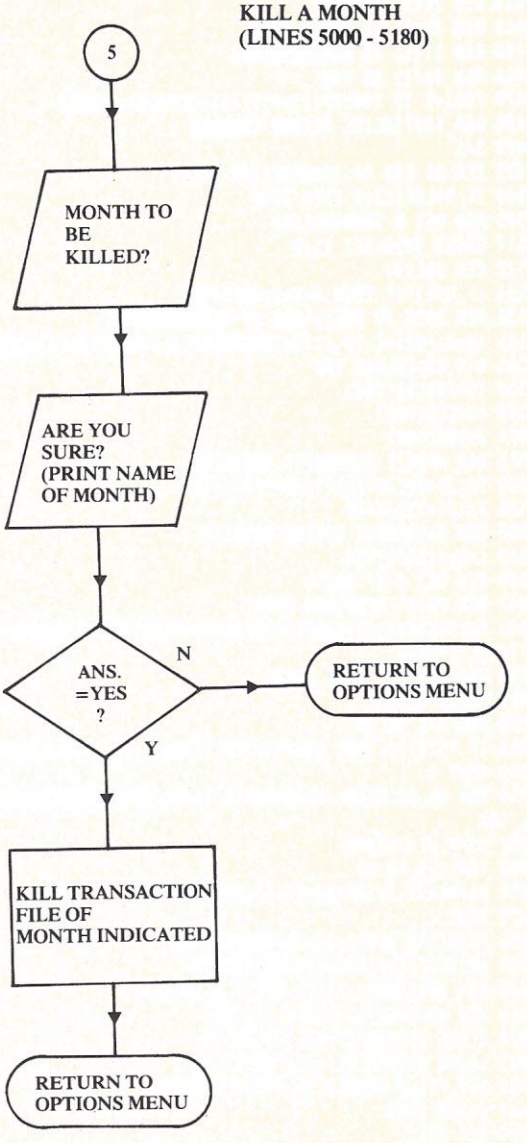
KILL A TRANSACTION (LINES 4000-4540)




```
4092 IF CVS(AC$)(>A1 THEN S=S+1:GOTO 4070
4093 REM THIS IS A CORRECT TRANSACTION; DISPLAY IT
4094 LF=1:GOSUB 8500
4096 INPUT"WANT TO KILL THIS TRANSACTION";YN$
4098 IF LEFT$(YN$,1)()"Y"THEN S=S+1:GOTO4070
4100 REM KILL TRANSACTION
4110 GOSUB10300:LSET V$="I":PUT #1,S:CLOSE:RETURN
4200 PRINT"END OF FILE.";CHR$(7):GOSUB10300:CLOSE:RETURN
```

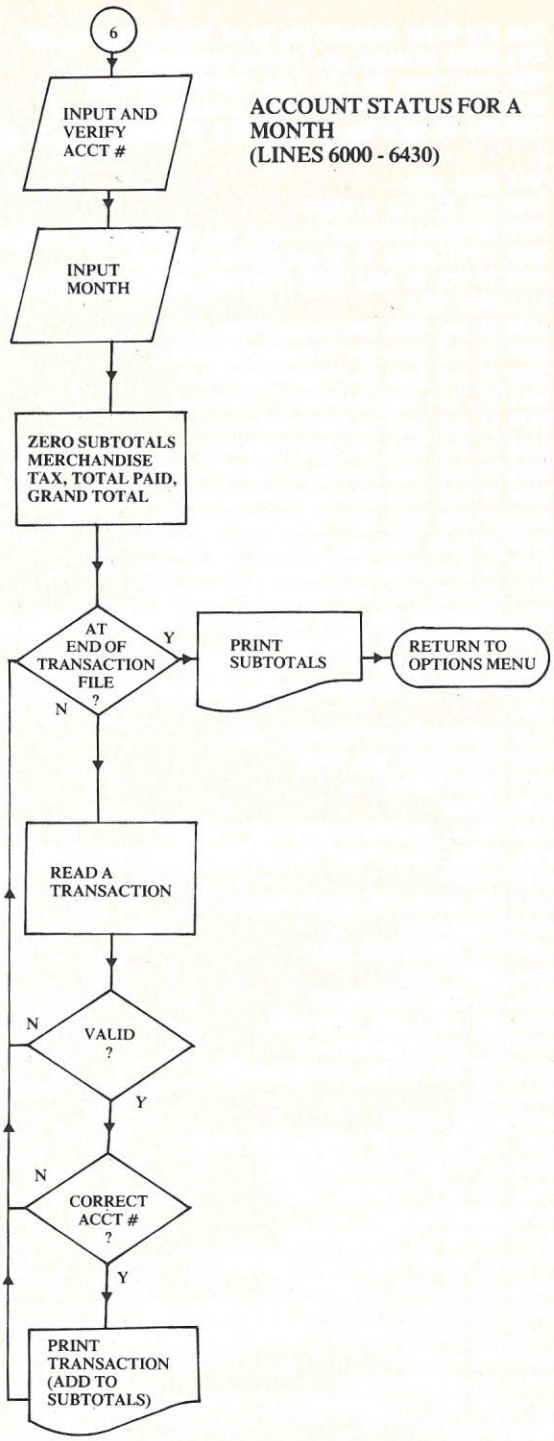
```
4500 REM PRINT TRANSACTION TO BE TENTATIVELY KILLED
4510 GOSUB 9020:GET #1,TI:LF=1:GOSUB8500
4520 INPUT"WANT TO KILL THIS TRANSACTION";YN$
4530 IF LEFT$(YN$,1)="Y" THEN S=TI:GOTO4110
4535 REM GO BACK AND ENTER ACCT # OF TRANSACTION TO BE KILLE
D
4540 GOTO 4050
5000 REM 5. KILL A MONTH
5005 GOSUB10300:PRINT"*** KILL ALL RECORDS FOR A MONTH ***"
5010 INPUT"MONTH TO BE KILLED";M:M=INT(M)
5020 IF M<1 OR M>12 THEN PRINT"USE MONTHS FROM 1 TO 12.";CHR
$(7):GOTO 5010
5030 IF M=1 THEN M$="JANUARY":M9$="1/"
5040 IF M=2 THEN M$="FEBRUARY":M9$="2/"
5050 IF M=3 THEN M$="MARCH":M9$="3/"
5060 IF  M=4 THEN M$="APRIL":M9$="4/"
5070 IF M=5 THEN M$="MAY":M9$="5/"
5080 IF M=6 THEN M$="JUNE":M9$="6/"
5090 IF M=7 THEN M$="JULY":M9$="7/"
5100 IF M=8 THEN M$="AUGUST":M9$="8/"
5110 IF M=9 THEN M$= "SEPTEMBER":M9$="9/"
5120 IF M=10 THEN M$="OCTOBER":M9$="10"
5130 IF M=11 THEN M$="NOVEMBER":M9$="11"
5140 IF M=12 THEN M$="DECEMBER":M9$="12"
5150 PRINT"ARE YOU SURE YOU WANT TO ERASE":PRINT"ALL RECORDS
 FOR THE MONTH OF ";M$;:INPUTYN$
5160 IF LEFT$(YN$,1)<>"Y" THEN 5175
5165 PRINT"ALL RECORDS FOR THE MONTH OF ";M$;" HAVE BEEN ERA
SED."
5169 CLOSE:OPEN "R",#1,"CTL"+M9$
5170 CLOSE:KILL "CTL"+M9$
5175 GOSUB 10300
5180 RETURN
6000 REM 6. ACCOUNT STATUS FOR A MONTH
6005 GOSUB 10300:PRINT"*** ACCOUNT STATUS FOR A MONTH (STATE
MENT) ***"
6010 REM INPUT AND VERIFY ACCT #
6020 GOSUB 8100
6030 REM OPEN TRANS FILE
6040 GOSUB 8300
6050 REM ZERO SUBTOTALS
6055 REM SEE LINES 6220-6250
6060 ZT=0:ZX=0:ZG=0:ZP=0
6070 REM INITIALIZE SECTOR COUNTER
6080 S=1
6085 GOSUB 10300
6087 REM AT END OF TRANSACTION FILE?
6090 IF S=LOF(1)+1 THEN 6400
6095 REM GET A TRANSACTION
6100 GOSUB 9020:GET #1,S
6110 REM VALID TRANSACTION?
6120 IF V$<>"V"THEN S=S+1:GOTO6090
6125 REM IS ACCT # CORRECT?
6130 IF CVS(AC$)<>A1 THEN S=S+1:GOTO 6090
6140 REM VALID CORRECT TRANSACTION HAS BEEN FOUND
6150 REM PRINT IT
6160 LF=1:GOSUB 8500
6170 REM ADD TO SUBTOTALS (T8 IS TOTAL MERCHANDAISE)
6180 ZT=ZT+T8
6185 REM TR$ IS TAX RATE
6190 ZX=ZX+(T8*CVS(TR$))
6200 ZG=ZG+(T8+(T8*CVS(TR$)))
6205 REM PD$ IS AMOUNT PAID
6210 ZP=ZP+CVS(PD$)
6220 REM- ZT IS MERCHANDAISE SUBTOTAL
6230 REM ZX IS TAX SUBTOTAL
6240 REM ZG IS GRAND TOTAL
6250 REM ZP IS TOTAL PAID
6255 GOSUB 10600
6257 REM INCREMENT SECTOR COUNTER
6260 S=S+1:GOTO6090
6400 PRINT:PRINT"TOTAL MERCHANDAISE- ";ZT
6410 PRINT"TOTAL TAX- ";ZX
6420 PRINT"GRAND TOTAL- ";ZG
6430 PRINT"TOTAL PAID- ";ZP:PRINT:PRINT:GOSUB 10300:RETURN
```

KILL A MONTH
(LINES 5000 - 5180)



Cash Register Program continued

```
7400 REM 8. EACH ACCTS TOTAL FOR A MONTH
7405 GOSUB 10300:PRINT"*** ALL ACCOUNTS TOTALS FOR A MONTH *
**"
7410 REM OPEN TRANS FILE
7420 GOSUB 8300
7430 REM ZERO MATRICES
7440 REM TP(I) IS TOTAL PAID
7450 REM TT(I) IS MERCHANDAISE
7460 REM TX(I) IS TAX
7470 FORI=1 TO 200:TP(I)=0:TT(I)=0:TX(I)=0:NEXT I
7480 REM INITIALIZE SECTOR COUNTER
7490 S=1
7495 REM AT END OF TRANSACTION FILE?
7500 IF S=LOF(1)+1 THEN 7800
7505 REM GET A TRANSACTION
7510 GOSUB 9020:GET #1,S
7520 REM VALID?
7530 IF V$()"V" THEN S=S+1:GOTO7500
7535 REM DATA IS VALID-ADD UP MERCHANDAISE
7540 T8=0:FORI=1 TO 4:T8=T8+CVS(Q$(I))*CVS(P$(I)):NEXTI
7545 REM CALCULATE TAX
7550 T9=T8*CVS(TR$)
7560 T6=CVS(PD$)
7570 J=CVS(AC$)
7575 REM UPDATE ACCOUNT'S SUBTOTALS
7580 TP(J)=TP(J)+T6:TT(J)=TT(J)+T8
7590 TX(J)=TX(J)+T9
7595 REM INCREMENT SECTOR COUNTER
7600 S=S+1:GOTO7500
7800 REM GET # OF ACCTS
7802 REM PRINT HEADINGS FIRST
7805 PRINTCHR$(16);CHR$(22):PRINT:PRINT"ACCT","MERCH.","TAX"
,"TOTAL","PAID"
7807 REM NOW GET # OF ACCTS
7810 GOSUB 8000
7820 FOR I=1 TO A9
7830 IF TT(I)>0 THEN PRINTI,TT(I),TX(I),TT(I)+TX(I),TP(I)
7840 NEXT I
7850 REM H1 IS TOTAL PAID,H2 IS TOTAL MERCHANDAISE,H3 IS TOT
AL TAX
7852 H1=0:H2=0:H3=0
7853 FOR I=1 TO A9
7854 H1=H1+TP(I):H2=H2+TT(I):H3=H3+TX(I)
7855 NEXT I
7856 PRINT"TOTALS:",H2,H3,(H2+H3),H1
7860 PRINT:PRINT:GOSUB10300:RETURN
8000 REM OPEN ACCT FILE, GET # OF ACCTS
8010 REM NO INPUTS, OUTPUT IS A9
8020 CLOSE 2:OPEN"R",#2,"CTLACCT"
8025 CLOSE 3:OPEN "R",#3,"CTLCNT"
8030 REM FIELD NUMBER OF ACCTS FORMAT
8040 GOSUB 9010
8050 GET #3,1
8060 A9=VAL(NC$)
8070 RETURN
8100 REM DISPLAY ACCT INFO
8130 A1=0:INPUT"ACCOUNT #(1-1000)";A1
8140 IF A1=0 THENPRINTCHR$(7):GOTO8130
8150 IF A1<1 OR A1>1000 THEN PRINT"USE ACCOUNT #'S BETWEEN 1
 AND 2000";CHR$(7)":GOTO8130
8160 CLOSE 2:OPEN "R",#2,"CTLACCT"
8170 REM USE ACCT FIELD STATEMENT
8180 GOSUB 9000:GET #2,A1
8195 PRINTCHR$(16);CHR$(22);:PRINT:PRINT
8200 PRINTN$:PRINTAD$:PRINTCS$:PRINTZ$:PRINT:PRINT"PH# ";:GO
SUB 10500
8210 IF VAL(TX$)()0 THEN PRINT"TAX EXEMPT #:";TX$
8215 PRINT"ATTN TO: ";AT$
```

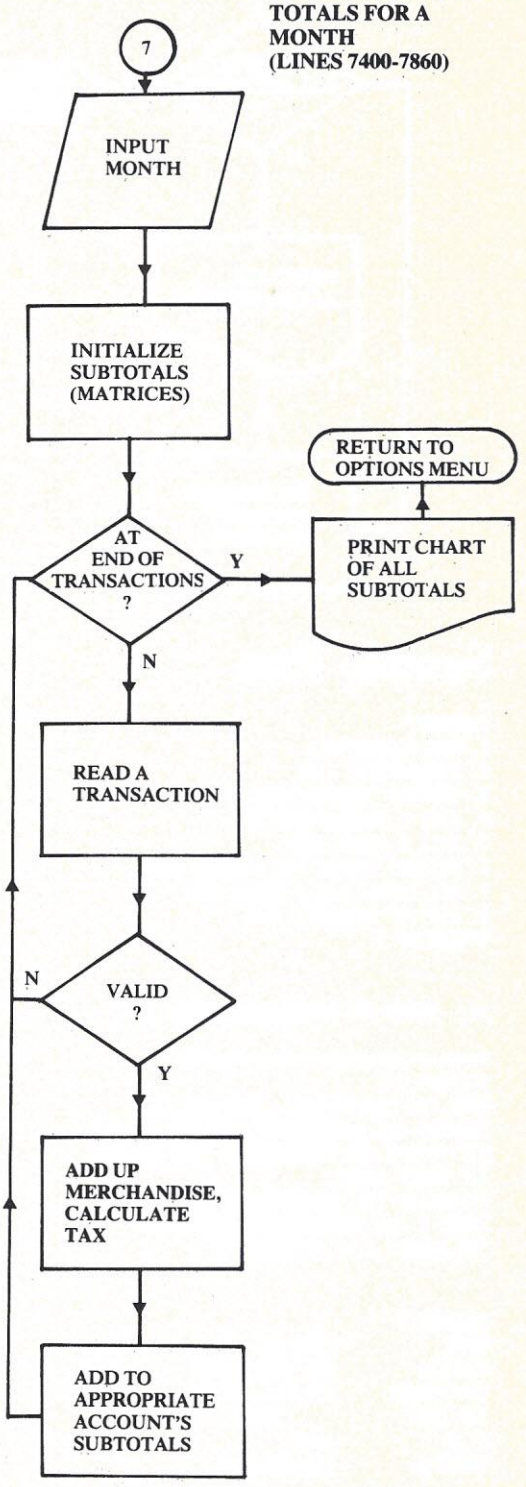


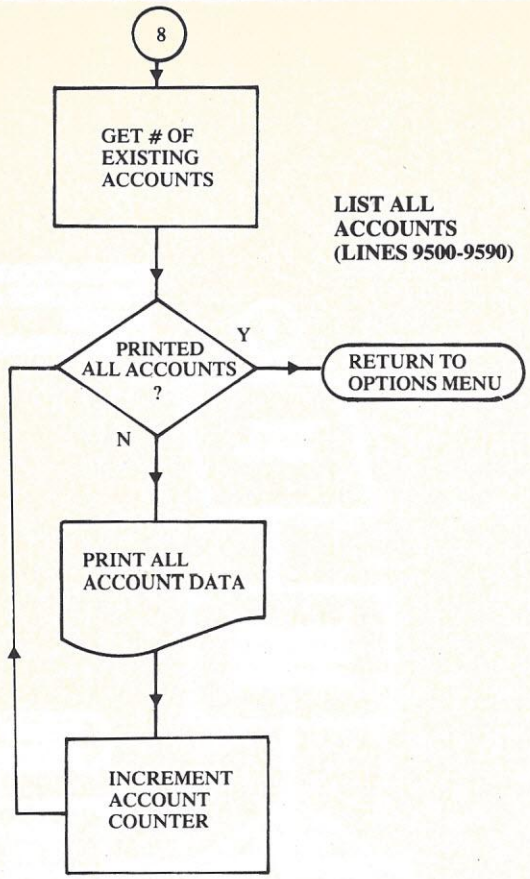
ACCOUNT STATUS FOR A MONTH
(LINES 6000 - 6430)

```
8230 INPUT"IS THIS THE CORRECT ACCOUNT";YN$
8235 PRINT"--- --- --- --- --- --- --- --- --- --- ---"
8240 IF LEFT$(YN$,1)="Y" THEN RETURN ELSE GOTO 8130
8300 REM INPUT TRANS DATE AND OPEN FILE
8330 DATA "1/","2/","3/","4/","5/","6/","7/","8/","9/","10",
"11","12","END"
8340 RESTORE:INPUT"DATE";DD$
```

```
8350 D9$=LEFT$(DD$,2)
8355 REM IF D8$="END" THEN DATE ENTERED WAS INVALID
8360 READ D8$:IF D8$="END" THEN 8380
8370 IF D8$=D9$ THEN 8390:REM IF SO, VALID DATE WAS ENTERED
8375 GOTO 8360
8380 PRINT"ENTER DATE AS FOLLOWS: M/D/Y."¡CHR$(7):GOTO8340
8390 REM VALID DATE ENTERED
8395 CLOSE1:OPEN "R",#1,"CTL"+D8$
8399 RETURN
8500 REM PRINT TRANSACTION
8510 REM CORRECT FILE IS OPEN
8520 REM RECORD HAS BEEN READ IN
8530 REM RECORD IS VALID
8540 PRINT:PRINT"DATE: "¡D$:PRINT"TRANSACTION #"¡LOC(1)-1
8542 PRINT"ACCOUNT #"¡CVS(AC$)
8543 IF LF=1 THEN LF=0:GOTO 8550:REM THIS SKIPS PRINTING NAM
E, ADDRESS WHEN SET
8545 PRINT:PRINTN$:PRINTAD$:PRINTCS$:PRINTZ$:PRINT"PH# "¡:GO
SUB10500:PRINT"ATTN: "¡AT$
8550 FOR I=1TO4:T(I)=0:NEXTI:FORI=1TO4
8555 REM IF PRICE IS 0 THEN SKIP THIS ITEM
8560 IF CVS(P$(I))=0 THEN8580
8562 GOSUB10400
8565 REM DISPLAY ITEM
8566 PRINT"ITEM"¡I:PRINT"PRICE-"¡CVS(P$(I))¡" QUANTITY-"¡CVS
(Q$(I)):PRINT"ITEM-"¡N$(I)¡"EXT-"¡CVS(Q$(I))*CVS(P$(I)):T(I)
=CVS(P$(I))*CVS(Q$(I))
8567 GOSUB 10400
8580 NEXT I
8585 T8=0:FORI=1TO4:T8=T8+T(I):NEXTI
8590 PRINT"SUBTOTAL-  "¡T8
8595 PRINT"TAX-  "¡T8*CVS(TR$)
8598 PRINT"TOTAL-  "¡T8+(T8*CVS(TR$))
8600 IF ST$<>"  " THEN PRINT"SHIP TO: "¡ST$
8610 PRINT"TOTAL PAID:  "¡CVS(PD$):PRINT:PRINT:RETURN
8999 REM ACCT FIELD STATEMENT
9000 FIELD #2,20 AS N$,20 AS AD$,20 AS CS$,5 AS Z$,20 AS AT$
,10 AS TX$,10 AS PH$
9002 RETURN
9005 REM NUMBER OF ACCOUNTS FORMAT
9010 FIELD #3, 8 AS NC$
9012 RETURN
9015 REM FIELD STATEMENT FOR TRANSACTIONS
9020 FIELD #1,1 AS V$,12 AS D$,4 AS AC$,15 AS N$(1),4 AS Q$(
1),4 ASP$(1),15 AS N$(2),4AS Q$(2),4 AS P$(2),15 AS N$(3),4
AS Q$(3),4 AS P$(3),15 AS N$(4),4 AS Q$(4),4 AS P$(4),4 AS T
R$,2 AS ST$,4 AS PD$
9022 RETURN
9500 REM 9. LIST ALL ACCTS
9505 GOSUB 10300:PRINT"*** LIST OF ALL ACCOUNTS ***"
9510 GOSUB 8000:REM GET # OF ACCTS
9520 FORI=1 TO A9
9530 PRINT:PRINT"ACCOUNT # "¡I
9540 GOSUB 9000:GET #2,I
9550 PRINTN$:PRINTAD$:PRINTCS$:PRINTTAB(5)¡Z$
9560 PRINT"PH # "¡:GOSUB 10500
9570 IF VAL(TX$)<>0 THEN PRINT"TAX EXEMPT # "¡TX$
9575 GOSUB 10400
9580 NEXT I
9585 PRINT"END OF LIST OF ACCOUNTS":GOSUB 10300
9590 PRINT:PRINT:RETURN
10000 REM MISCELLANEOUS SUBROUTINES
10300 PRINT"*** *** *** *** *** *** *** *** *** ***":PRINT:R
ETURN
10400 PRINT"- - - - - - - - - - - - - - -":RETURN
10500 PRINTLEFT$(PH$,3)+"-"+MID$(PH$,4,3)+"-"+RIGHT$(PH$,4):
RETURN
10600 PRINT"<> <> <> <> <> <> <> <> <> <> <> <>":RETURN
```

EACH ACCOUNT'S TOTALS FOR A MONTH (LINES 7400-7860)





MISCELLANEOUS ROUTINES

1 Get # of existing accts.
Lines 8000 - 8070
Returns # in "A9"

2 Input and verify account #
Lines 8100 - 8240
Returns account # in "A1"

3 Input date of transaction(s)
Lines 8300 - 8399
Inputs date, opens correct transaction file. (Transactions are organized in 12 separate files, by month.)

4 Print a transaction
Lines 8500 - 8610
Prints all details of a transaction. The transaction file must be open, and a record read in, prior to calling this routine. If "LF" is set to 1, the printing of name/address, etc., will be suppressed.

Sample Run

```
COMMAND?
1. NEW ACCOUNT(AC)
2. TRANSACTION (TR)
3. MONTH'S TRANSACTIONS (MT)
4. KILL A TRANSACTION (KT)
5. KILL A MONTH (KM)
6. ACCOUNT STATUS FOR A MONTH (AS)
7. ALL TOTALS FOR A MONTH (AT)
8. LIST OF ACCOUNTS (LI)
OPTION #? 1


***  ENTER NEW PERMANENT ACCOUNT ***

*******************************
ACCOUNT # 1
NAME (20 CHARACTERS)? JOHN DOE TV
ADDRESS (20 CHARACTERS)? 123 PARK PLACE
CITY/STATE (20 CHARACTERS) ?N.Y.C., N.Y.
ZIP CODE? 10010
ATTENTION TO: (20 CHARACTERS)? JOHN
PHONE # (10 CHARACTERS)? 2123334444
TAX EXEMPT # (0 IF NONE)? 0


ACCOUNT #       1
NAME            JOHN DOE TV
ADDRESS         123 PARK PLACE
CITY/STATE      N.Y.C., N.Y.
ZIP CODE            10010
ATTN:           JOHN
PHONE #         212-333-4444


CORRECT? Y
NEW PERMANENT ACCOUNT INFORMATION IS NOW STORED ON DISK.

*********************************
```

```
COMMAND? AC


***  ENTER NEW PERMANENT ACCOUNT ***

*******************************
ACCOUNT # 2
NAME (20 CHARACTERS)? JOHN SMITH RADIO
ADDRESS (20 CHARACTERS)? 335 3RD AVE.
CITY/STATE (20 CHARACTERS) ?OSHKOSH,MICH.
ZIP CODE? 33268
ATTENTION TO: (20 CHARACTERS)? PEDRO
PHONE # (10 CHARACTERS)? 4359998888
TAX EXEMPT # (0 IF NONE)? 4563
```

```
CITY/STATE      N.Y.C.,N.Y.
ZIP CODE            10006
ATTN:           FRANK
PHONE #         212-333-4567
TAX EXEMPT #    5556


CORRECT? Y
NEW PERMANENT ACCOUNT INFORMATION IS NOW STORED ON DISK.

*********************************

COMMAND? LI
*** *** *** *** *** *** *** *** *** ***

*** LIST OF ALL ACCOUNTS ***

ACCOUNT #  1
JOHN DOE TV
123 PARK PLACE
N.Y.C., N.Y.
     10010
PH # 212-333-4444
- - - - - - - - - - - - - - -
```

```
ACCOUNT #  2
JOHN SMITH RADIO
335 3RD AVE.
OSHKOSH,MICH.
     33268
PH # 435-999-8888
TAX EXEMPT # 4563
- - - - - - - - - - - - - - -

ACCOUNT #  3
MARY DOE HI-FI
1111 NEW ST.
N.Y.C.,N.Y.
     10006
PH # 212-333-4567
TAX EXEMPT # 5556
- - - - - - - - - - - - - - -
END OF LIST OF ACCOUNTS
*** *** *** *** *** *** *** *** *** ***

COMMAND? TR
*** *** *** *** *** *** *** *** *** ***

*** ENTER A TRANSACTION ***
DATE? 4/9/79
ACCOUNT #(1-1000)? 2


JOHN SMITH RADIO
335 3RD AVE.
OSHKOSH,MICH.
33268

   PH# 435-999-8888
TAX EXEMPT #:4563
ATTN TO: PEDRO
IS THIS THE CORRECT ACCOUNT? Y
--- --- --- --- --- --- --- --- --- ---
IS THIS A CASH ACCT.? N
TAX RATE (0 IF EXEMPT)? 0
SHIP-TO STATE (TWO LETTERS, TYPE 'RETURN' IF NONE)? MI
HOW MANY ITEMS (MAXIMUM OF 4)? 2
DESCRIPTION OF ITEM #  1  (15 CHARACTERS MAX.)
ZENITH RADIO
QUANTITY OF ITEM # 1 ? 5
UNIT PRICE OF ITEM # 1 ? 89.75
DESCRIPTION OF ITEM #  2  (15 CHARACTERS MAX.)
SPEAKER WIRE
QUANTITY OF ITEM # 2 ? 10
UNIT PRICE OF ITEM # 2 ? 2.50


*** *** *** *** *** *** *** *** *** ***


DATE: 4/9/79

TRANSACTION # 1
ACCOUNT # 2


SOLD BY:
ABCD ELECTRONICS, 123 WEST EGG, N.Y.C., N.Y.

BOUGHT BY:
JOHN SMITH RADIO
335 3RD AVE.
OSHKOSH,MICH.
33268

   PH# 435-999-8888
ATTN:  PEDRO
TAX EXEMPT # 4563
SHIP TO:MI


*** *** *** *** *** *** *** *** *** ***

QUANTITY-  5    PRICE-   89.75    ITEM- ZENITH RADIO   EXT-
 448.75

QUANTITY-  10    PRICE-   2.5    ITEM- SPEAKER WIRE   EXT-   25

TOTAL MERCHANDAISE:  473.75
TAX  : 0
TOTAL:   473.75


AMOUNT PAID? 473.75
*** *** *** *** *** *** *** *** *** ***


IS INVOICE CORRECT? Y


*** *** *** *** *** *** *** *** *** ***

OFFICE COPY #1


DATE: 4/9/79
TRANSACTION # 1
ACCOUNT # 2

JOHN SMITH RADIO
335 3RD AVE.
OSHKOSH,MICH.
33268
   PH# 435-999-8888
ATTN: PEDRO
- - - - - - - - - - - - - - -
ITEM 1
PRICE- 89.75  QUANTITY- 5
ITEM-ZENITH RADIO   EXT- 448.75
- - - - - - - - - - - - - - -
- - - - - - - - - - - - - - -
ITEM 2
 PRICE- 2.5  QUANTITY- 10
ITEM-SPEAKER WIRE   EXT- 25
- - - - - - - - - - - - - - -
SUBTOTAL-   473.75
TAX-   0
TOTAL-   473.75
SHIP TO: MI
TOTAL PAID:   473.75


*** *** *** *** *** *** *** *** *** ***

OFFICE COPY #2
```

```
COMMAND? AS
*** *** *** *** *** *** *** *** *** ***

*** ACCOUNT STATUS FOR A MONTH (STATEMENT) ***
ACCOUNT #(1-1000)? 1


JOHN DOE TV
123 PARK PLACE
N.Y.C., N.Y.
10010

PH# 212-333-4444
ATTN TO: JOHN
IS THIS THE CORRECT ACCOUNT? Y
--- --- --- --- --- --- --- --- --- --- ---
DATE? 4/
*** *** *** *** *** *** *** *** *** ***
```

Cash Register
Sample Run continued

```
DATE: 4/12/79
TRANSACTION # 2
ACCOUNT # 1
- - - - - - - - - - - - - - - -
ITEM 1
PRICE- 900  QUANTITY- 8
ITEM-BETAMAX        EXT- 7200
- - - - - - - - - - - - - - - -
SUBTOTAL-   7200
TAX-   576
TOTAL-   7776
TOTAL PAID:   7776


<> <> <> <> <> <> <> <> <> <> <> <> <>

DATE: 4/15/79
TRANSACTION # 3
ACCOUNT # 1
- - - - - - - - - - - - - - - -
ITEM 1
PRICE- 120  QUANTITY- 10
ITEM-CASSETTES      EXT- 1200
- - - - - - - - - - - - - - - -
SUBTOTAL-   1200
TAX-   96
TOTAL-   1296
TOTAL PAID:   1000


<> <> <> <> <> <> <> <> <> <> <> <> <>

TOTAL MERCHANDISE-  8400
TOTAL TAX-  672
GRAND TOTAL-  9072
TOTAL PAID-  8776
```

```
*** *** *** *** *** *** *** *** *** ***

*** ALL ACCOUNTS TOTALS FOR A MONTH ***
DATE? 4/


ACCT        MERCH.      TAX         TOTAL       PAID
 1           8400        672         9072        8776
 2           473.75      0           473.75      473.75
TOTALS:      8873.75     672         9545.75     9249.75


*** *** *** *** *** *** *** *** *** ***
```

```
COMMAND? KT
*** *** *** *** *** *** *** *** *** ***

*** KILL A TRANSACTION ***
DATE?'4/
TRANSACTION # TO BE KILLED ('RETURN' IF UNKNOWN)?
ACCOUNT #(1-1000)? 2
```

```
WANT TO KILL THIS TRANSACTION? N

DATE: 4/15/79
TRANSACTION # 3
ACCOUNT # 1
- - - - - - - - - - - - - - - -
ITEM 1
PRICE- 120  QUANTITY- 10
ITEM-CASSETTES      EXT- 1200
- - - - - - - - - - - - - - - -
SUBTOTAL-   1200
TAX-   96
TOTAL-   1296
TOTAL PAID:   1000


WANT TO KILL THIS TRANSACTION? Y
*** *** *** *** *** *** *** *** *** ***
```

```
ACCT        MERCH.      TAX         TOTAL       PAID
 1           7200        576         7776        7776
 2           473.75      0           473.75      473.75
TOTALS:      7673.75     576         8249.75     8249.75


*** *** *** *** *** *** *** *** *** ***


COMMAND? KM
*** *** *** *** *** *** *** *** *** ***

*** KILL ALL RECORDS FOR A MONTH ***
MONTH TO BE KILLED? 4
ARE YOU SURE YOU WANT TO ERASE
ALL RECORDS FOR THE MONTH OF APRIL? YES
ALL RECORDS FOR THE MONTH OF APRIL HAVE BEEN ERASED.
*** *** *** *** *** *** *** *** *** ***


COMMAND? MT
*** *** *** *** *** *** *** *** *** ***

*** ALL MONTHLY TRANSACTIONS ***
DATE? 4/

END OF LIST OF TRANSACTIONS.
*** *** *** *** *** *** *** *** *** ***
```

WANTED:

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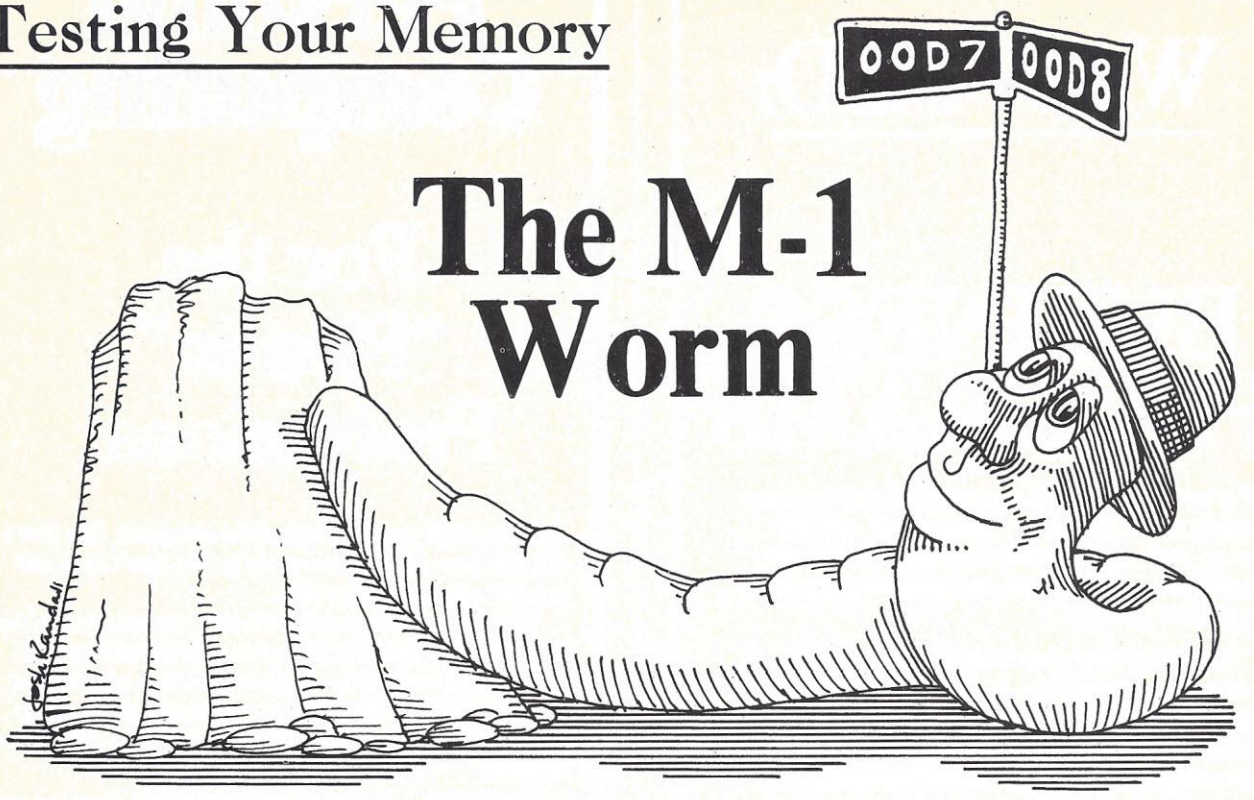
The M-1 Worm



BY HENRY MELTON

A serious flaw exists in most standard memory test routines when applied to Z-80 systems. A board can be tested for hours and never drop a bit, then when it's loaded with a program, fail instantly. The problem is quite simple: access timing on a Z-80 instruction fetch (the M-1 cycle) is significantly more critical than on a simple read cycle. No matter how fancy a normal memory test gets, it never makes the speed demands on the memory that an actual program does. The only way to check this memory for full speed operation is to actually run a program in it. The M-1 Worm does just that.

There are three processors in common use with very similar instruction sets and timing — the 8080, the 8085 and the Z-80. Table 1 gives a simple idea of the memory timing requirements for each of them.

Notice that the timing requirements of both the 8085 and the Z-80 are less strict than that of the older 8080. It's been advertised that an 8085 running at 3 MHz will operate properly with the same memory that a 2 MHz 8080 requires. Neither the 8080 nor the 8085 present a problem for the memory test programs since the M-1 instruction fetch and the ordinary read cycle use identical timing. Notice, however, that the Z-80 instruction fetch is a half-T-state shorter than the ordinary read.

If the only way to test the memory at full speed is to fetch instructions from it, then load a program and see if it blows up. It's a good go/no-go test, but hopefully we can get more information about our marginal memory with a properly designed set of instructions.

The Worm

There are two parts of the test program. There is a cluster of service routines down in the restart area of memory which I call the Rock. But the actual test program is a short twelve-byte Worm that, upon initiation, breaks off the Rock and crawls up through memory space, giving a running travelogue as he goes. If he stops talking, you know something bad happened, and where.

The Worm acts as the main program loop. It manipulates two test bytes and calls two subroutines. One of the subroutines reports the location of the Worm and detects and reports any errors in the manipulation of the test bytes. The other subroutine shifts the Worm up in memory one location and adjusts the return to begin execution of the worm for another loop. There are seven instruction fetches per loop, with the data manipulation instructions in complimentary pairs (0A and F5, 3E and C1) to insure full-speed testing on both ones and zeroes.

The instruction RESTART 7, hex-FF, is embedded in the Worm in non-executable locations as traps in case a memory error causes the program counter to get out of sync. The Worm leaves a slime-trail of FFs behind as it travels. Any execution of a trap is reported and the trap subroutine attempts to return execution back to the Worm.

Table 1 Memory Timing Requirements

	8080	8085	Z-80
M-1 addr	3/2	5/2	2
M-1 DBIN	1	3/2	3/2
RD addr	3/2	5/2	5/2
RD DBIN	1	3/2	2
$\overline{WR}$ addr	3/2	1	3/2
$\overline{WR}$	1	3/2	1

All times are only approximate. Times are multiples of the system clock.

The Rock

The Rock is a mundane set of service routines used for checking for data errors and reporting the errors and addresses in Hexadecimal ASCII. This part of the program has to reside in the lower part of memory to make use of the restart locations. It could be rewritten with explicit subroutine calls instead of using the restart instructions, allowing it's insertion in monitor ROM perhaps, but it would be far less reliable. There are FFs everywhere in an S-100 system. Since the program is designed to blow up, it's best to insure the best chances for recovery from the blowup.

The output routines listed are for two different monitors, the TDL ZAPPLE and the Processor Technology CUTTER. Otherpatches to monitors can be inserted there by moving the data byte at AF and stealing a few bytes of the stack area. More stack is provided in the listing than is actually used.

The data error reports indicate which data byte was garbled, and what the erroneous value was. Possibly, the type of memory error could be diagnosed from this data. Value A should be FF. Value B should be 00. A trap error is flagged by a T followed by the address.

Procedure

If you have other memory test routines, use those first. They can give you the bit-by-bit data you need to correct the bad-chip or shorted-address-line type of error. The Worm is designed to be a final verification of memory prior to use. Load the program into low memory. I have a copy in ROM in my system with a short routine that downloads the test routine into RAM and jumps to it.

The Worm should immediately start reporting its location. The first address will be 00D7. Sequential addresses will continue until bad memory, no memory or ROM. Bad memory will trash the program, or else trigger the error reports. No memory looks like a string of FFs, and the Rock will report a sequential string of traps. When ROM is hit, execution of the ROM program will begin.

Errors will occur most often at or near chip and board boundaries. I have found, on my system, trap errors more frequently than data errors, and A errors more frequently than B data errors.

The speed of testing is limited by the speed of the output. A 110-baud terminal would only allow two bytes per second to be tested; 1200-baud would allow twenty. Eliminating the Address Output subroutine call at 004A allows the Worm to speed along at 4K per second, if you're willing to give up the travelogue.

The Rock and the Worm are written in 8080 code to allow their use on all three processors. Although the specific problem is Z-80 related, there are bottlenecks on memory speed other than the CPU timing. Support logic and bus drives add their own delays. The purpose of testing, after all, is to determine if your system is close to the theoretical. It never hurts to check. □

Program Listing

Initialization

```
0000  31 D0 00      LXI SP,00D0     Set stack pointer
0003  01 AF 00      LXI BC,00AF     Set test data address
0006  C3 D1 00      JMP 00D1        Jump to Worm
0009  FF FF FF FF
      FF FF FF      RST 7           Trap area
```

Move Worm

```
0010  E1            POP H           Get address of Worm +1
0011  54            MOV D,H         Duplicate address into DE
0012  5D            MOV E,L
0013  1B            DCX D           Set DE to last address of Worm
0014  06 0C         MVI B,0C        Set length of Womm
0016  1A            LDAX D          Get byte of Worm
0017  77            MOV M,A         Move it up one location
0018  1B            DCX D           Adjust pointers
0019  2B            DCX H
001A  05            DCR B           Test B for end of move
001B  78            MOV A,B
001C  FE 00         CPI,00
001E  C2 16 00      JNZ 0016        Loop until done
0021  01 AF 00      LXI B,00AF      Restore BC
0024  23 23         INX H, INX H    Adjust HL to start of Worm
0026  E9            PCHL            Return to Worm
0027  FF            RST 7           Trap
```

Report Address

```
0028  FE FF         CPI, FF         Check A for error
002A  C2 51 00      JNZ 0051        Jump to "ERROR A"
002D  78            MOV A,B         Check B for error
002E  FE 00         CPI, 00
0030  C2 65 00      JNZ 0056        Jump to "ERROR B"
0033  C3 49 00      JMP 0049        Jump to "REPORT ADDRESS PART 2'
0036  FF FF         RST 7           Trap
```

Trap

```
0038  3E 54         MVI A, "T"      Output a "T"
003A  CD A8 00      CALL 00A8       Call "OUTPUT"
003D  3E 20         MVI A,SPACE     Output a space
003F  CD A8 00      CALL 00A8       Call "OUTPUT"
0042  E1            POP H           Recover address
0043  2B            DCX H           Adjust address
0044  CD 73 00      CALL 0073       Call "ADDRESS OUTPUT"
0047  23            INX H           Adjust Address
0048  E9            PCHL            Return
```

Report Address Part 2

```
0049  E1            POP H           Recover address
004A  CD 73 00      CALL 0073       Call "ADDRESS OUTPUT"
004D  23            INX H           Adjust return address
004E  23            INX H
004F  23            INX H
0050  E9            PCHL            Return
```

Error A

```
0051  06 41      MVI B,"A"     Put "A" in B
0053  C3 58 00   JMP 0058      Jump to "ERROR PRINT"
```

Error B

```
0056  06 42      MVI B,"B"     Put "B" in B
                                Fall through to "ERROR PRINT"
```

Error Print

```
0058  4F          MOV C,A       Save error data
0059  3E 2A      MVI A,"*"     Output "*"
005B  CD A8 00    CALL 00A8     Call "OUTPUT"
005E  3E 20       MVI A,SPACE   Output a space
0060  CD A8 00    CALL 00A8     Call "OUTPUT"
0063  78          MOV A,B       Output error type
0064  CD A8 00    CALL 00A8     Call "OUTPUT"
0067  3E 20       MVI A,SPACE   Output a space
0069  CD A8 00    CALL 00A8     Call"OUTPUT"
006C  79          MOV A,C       Output error data
006D  CD 8B 00    CALL 008B     Call "BYTE OUTPUT
                                     WITH CR-LF"
0070  C3 49 00    JMP 0049      Jump to "REPORT ADDRESS
                                     PART 2"
```

Address Output

```
0073  E5          PUSH H        Save address
0074  7C          MOV A,H
0075  CD 7E 00    CALL 007E     Call "BYTE OUTPUT"
0078  7D          MOV A,L
0079  CD 8B 00    CALL 008B     Call "BYTE OUTPUT WITH CR-LF"
007C  E1          POP H         Restore HL
007D  C9          RETURN
```

Byte Output

```
007E  F5          PUSH PSW      Save A
007F  0F          RRC           Shift nybble
0080  0F          RRC
0081  0F          RRC
0082  0F          RRC
0083  CD 99 00    CALL 0099     Call "NYBBLE OUTPUT"
0086  F1          POP PSW       Restore A
0087  CD 99 00    CALL 0099     Call "NYBBLE OUTPUT"
008A  C9          RETURN
```

Byte Output With CR-LF

```
008B  CD 7E 00    CALL 007E     Call "BYTE OUTPUT"
008E  3E 0D       MVI A,"CR"    output carrage return
```

```
0090  CD A8 00      CALL 00A8   Call "OUTPUT"
0093  3E 0A         MVI A,"LF"  Output line feed
0095  CD A8 00      CALL 00A8   Call "OUTPUT"
0098  C9            RETURN
```

Nybble Output

```
0099  E6 0F         ANI 0F      Strip high nybble
009B  FE 0A         CPI 0A      Divide alpha vs. numeric
009D  FA A2 00      JM 00A2     Jump if numeric
00A0  C6 07         ADI 07      Add alpha offset
00A2  C6 30         ADI 30      Add numeric offset
00A4  CD A8 00      CALL 00A8   Call "OUTPUT"
00A7  C9            RETURN
```

Output (Cutter Option)

```
00A8  C5            PUSH B      Save BC
00A9  47            MOV B,A
00AA  CD 19 C0      CALL C019   Call "CUTTER OUTPUT"
00AD  C1            POP B       restore BC
00AE  C9            RETURN
```

Output (TDL Zapple Option)

```
00A8  C5            PUSH B      Save BC
00A9  4F            MOV C,A
00AA  CD 09 F0      CALL F009   Call "TDL ZAPPLE OUTPUT"
00AD  C1            POP B       Restore BC
00AE  C9            RETURN
```

Data Byte

```
00AF  00
```

Stack Area

00B0-00CF

Worm

```
00D0  FF            RST 7       TRAP
00D1  0A            LDAX B      Move data to A; start of Worm
00D2  F5            PUSH PSW    Push test data onto stack
00D3  3E FF         MVI A,FF    Move second test byte to A
00D5  C1            POP B       Pop first test byte into B
00D6  EF            RST 5       Call "REPORT ADDRESS"
00D7  FF            RST 7       Trap
00D8  FF            RST 7       Trap
00D9  FF            RST 7       Trap
00DA  00            NOP         "REPORT ADDRESS" return location
00DB  D7            RST 2       Call "MOVE WORM";
                                    return to start of Worm
```

Hetty Green

BY LARRY EISENBERG

I had always detested Grenby, second Vice President of the Eden International Bank. A tyrant to his subordinates and a bootlicker to his superiors, he went about the office bending down and picking up bits of paper. I was surprised one day when he came into the Computer Room, erect and leading a distinguished-looking gentleman — Amos Feather, once the whiz kid of the financial world (as I had been once myself), and now our new Chairman of the Board. Feather was tall, thin, with short snow-white hair and an impeccably trimmed fine white mustache. One corner of his thin-lipped mouth twitched perpetually as though he were about to break into a saturnine grin.

I had one hand on Hetty and I radiated confidence. Grenby made the obligatory introductions in a simpering manner.

"I've heard of you," said Amos Feather.

"Nothing bad I hope?"

"It depends on one's point of view," said Feather. And the saturnine grin flashed on briefly.

I looked at him noncommittally and he reached past me and put the tip of his index finger on Hetty. I bit my lip but said nothing.

"This must be the computer you use to assist you in buying and selling," he said, his blue eyes glinting wickedly.

"That's true," I said.

"What's so special about it? I mean, every housewife with an extra hundred dollars in the cookie jar has a microcomputer managing her budget. And banks have been using computers in financial transactions for the past twenty years."

"This is no ordinary computer," I said. "HG was put together according to my specifications."

"HG? I thought it was an LSI 890?" said Feather abruptly.

For a moment my cool composure evaporated and I blushed. "I call her Hetty Green after the great financier of the early 1900s who garnered a fortune of a hundred million dollars. She was assembled out of an LSI 890 kit but I wrote most of her software. And we've worked together so well and so long she's taken on a personality of her own to me."

"There are newer generation machines that can do a hell of a lot more."

I was angered by this slight. "Perhaps," I said grimly, "you've been told that I worked out a unique computerized model of the international commodities market covering items like wheat, hides, copper, fossil fuels, gold and all currencies. The devilish complexity of this model demands an ultrafast computer for online operation with ten megabytes of memory."

"I guess it does," said Feather. "Still, it doesn't seem to be enough. I've gone over your last year's records and your balance is dropping sharply. Or is it the fault of Hetty Green?"

I forced myself to smile. "*I* make all the decisions. Hetty just carries out whatever computational instructions I give her. But I'd like to point out that last year was a particularly difficult year. There were problems with the dollar—"

"I know, I know," waved Feather, interrupting my defense. "Oil prices went up; and besides, you always showed a profit in preceding years. Maybe you've just gotten too old for this game." And he looked over at Hetty Green, smiling what he apparently thought an ingratiating smile. "You're over 57 now. She's 12. That puts both of you into the twilight zone in this business."

I looked at his snow-white hair. He reached up and brushed his fingers over the thick strands.

"I'm only forty eight, myself," he said. "All of this is prematurely gray. My hair turned color at thirty."

Abruptly he put out his hand and, because I didn't know what else to do, I shook it. "Thanks for your explanations," he said. "I wish you and Hetty Green every success, particularly in the near future."

He walked off gracefully and with dignity, preceded by Grenby, who demonstrated his unparalleled expertise in bowing and scraping. Feather's short, trim white hair gleamed under the illuminating ceiling panels. I watched him leave with a sense of foreboding.

"Forty eight, indeed," I said aloud. "He'll never see fifty again. Puts us in the twilight zone. What a miserable —"

"He is," said a soft voice. It was that of Hetty Green.

There had been no need to give Hetty a vocal output. I had programmed her to receive a very wide range of vocal commands and given her a high speed printer output as well as tapes and floppy disks. But for the sheer fun of it, I had decided to give her the entire speech software/hardware package that came as an option to the kit. And I had selected the vocal quality of my mother's voice. My wife called it an Oedipal decision.

"We've got to be more gung-ho than ever," I said to Hetty. "This Feather is out to get me. We've got to be more canny and more cautious in our trading."

"We've got to be more daring," said Hetty.

"What's that? What did you say?"

"More daring," said Hetty.

"That's the path to disaster," I said. "It means gambling, and I'm too old to gamble."

"You're too old *not* to gamble," said Hetty.

"Damn it," I said. "You sound more and more like my mother every day."

That night I told my wife what had happened. She had set a savory dinner on the table as I came in, a chicken garnished with truffles, accompanied by asparagus in a delicate cheese sauce. I ate my way through it without conversation. Then I sighed.

"That was magnificent!" I said. "Was there some special occasion I wasn't aware of?"

"No special occasion. I wanted to do something for you that Hetty Green can't."

"Why? Do you still see her as a rival?"

My wife smiled. "You spend more time with Hetty every day than you do with me."

"But she's only a computer, a compendium of integrated circuit chips, bubble memory — "

"When you get down to the molecular level," said my wife, "none of us are *that* different."

I smiled wanly and told her what Amos Feather had said. She shook her head sadly.

"He does have power," she said. "And he's looking to get rid of you. Your salary and bonuses are too high, your reputation is as good as his own. You're a potential threat to him."

"I've got to do better this year," I said grimly. "I'm not sure I can. But I'll try."

"Too old at fifty seven?" mused my wife. "My father was still running his business, and running it well, at eighty."

I scraped the leavings off the dishes and put them in the dishwasher. "So will I," I said. "If they let me."

All hell broke loose on the copper market the following week. There was a threat of war on the Persian Gulf. Copper prices began to skyrocket.

I entered a large buying order into Hetty Green.

"Sell," said Hetty.

"Listen," I said, very much taken aback at her first act of insubordination in twelve years. "You just execute my instructions and let me make the decisions."

"Please *sell* copper," said Hetty.

I don't know how she achieved it, but she injected a note of urgency in her voice.

"Ridiculous," I said. "There's every indication copper is on the way up. It always happens when there's a threat of war."

"The threat is spurious," said Hetty. "Sell!"

"How the hell would you know that?" I bellowed.

There was no answer. I looked at the blue painted flanks of her cabinet. "All right," I said. "We'll sell. But if you're wrong, it's all up with me and with you, too. They've got a new generation of computer that'll replace you with half the hardware."

I changed my entry and went back to my desk to sulk for a while. Then I began to sweat. What the hell had I done? Listening to a computer as though it were a sentient being was an act bordering on lunacy. I'd written every bit of the software, except for the vocal output. So whatever Hetty was saying came out of my own algorithms in some involuted, obscure way.

"You're over 57 now. She's 12. That put's both of you into the twilight zone in this business."

I rarely took my lunch before two. Today I left at one. But first I called my good friend, Dr. Bob Hangarten.

Bob Hangarten was not Viennese though he looked like one. He was a psychiatrist and a damned good one. He had received his analytic training at the hands of a man who had trained with a man who had been analyzed by Sigmund Freud himself. Bob was also my best friend. We'd gone through high school together, where we'd co-chaired the Computer Club. He wore three-piece suits and had a gold watch and a heavy gold chain bearing a Phi Beta Kappa key.

"Come on over," he said. "We'll have lunch together."

When I arrived, his receptionist sent me right in. Bob looked at me expectantly but said nothing.

"Don't try your psychoanalytic tricks on me," I said. "Where are we eating?"

"How about right here?" asked Bob. "I can order hot corned beef sandwiches, pickles, the works."

When the sandwiches arrived, I began to salivate like one of Pavlov's dogs. Then I tore into my sandwich. After a while I came up for air.

"Wouldn't you say that's a pretty good appetite for a man going on fifty eight?"

Bob smiled. "Somebody been twitting you about your age?"

"Just my boss."

He bit into his sandwich and chewed slowly. I admired his magnificent self control.

"Sounds like he got under your skin."

"I think he wants all of it," I said. "But what bothers me even more is how I'm reacting to Hetty Green." I told him what happened that morning. "And if copper continues to go up, I'll be out on the sidewalk," I said.

"It's a little peculiar," said Bob. "After all, a computer is just a compilation — "

"Of chips and memory. I know."

"Let me finish," said Bob. "On the other hand, whatever she tells you to do comes out of your own program and the real data. So you're taking your own advice, so to speak. Provided she's not malfunctioning."

I put down the sandwich. "That's a comforting thought," I said.

At three I was back. The rumors of war had been dispelled by an announcement from the Shah of Iran and copper had plummetted. I had brought in a quick profit of three quarters of a million dollars to the Eden International Bank! I sat down at my desk and mopped my brow.

"I don't believe it," I said softly.

"But it's true," said Hetty Green.

"Don't say 'I told you so, '" I said to myself.

"I told you so," said Hetty Green.

I sighed. "You were right, *this* time, Hetty. But don't get exaggerated notions of your analytic powers. We'll take 'em one at a time."

But thereafter, more and more, Hetty began to resist my buying instructions. And when I overrode her objections and persisted in my instructions, she would sometimes nullify my entries

and carry out her own. The first time I became aware of this occurrence, I was enraged. But as with the copper deal, Hetty proved to be right and I wrong. This time she was right by half a million dollars.

I stopped resisting.

A memo came from Amos Feather five weeks later. It was brief and to the point. "Your accounts are doing very well. Congratulations. AF."

I crumpled the message and lofted it into the waste basket. I hadn't done it. Hetty had. And I resented it.

The next month my net trading balance went up an astounding fifteen percent — an unprecedented gain. Amos Feather came by to congratulate me in person. The corner of his mouth was not twitching when he spoke to me so I knew he was really impressed. So was I. Nothing I would have done that month would have come close to that big a profit. I'd even been out with the flu for five days.

I called Bob Hangarten and asked to see him.

"This is not a friendly call," I said. "It's purely for medical advice."

"Come ahead," he said.

"What can I tell you?" I said bitterly. "Since Hetty calls the shots, my accounts have done better than ever. Amos Feather not only doesn't want to fire me, he comes down to see me and personally congratulate me. He hints of bigger stock options and tax exempt bonuses. In short, my cup should runneth over."

"But," said Bob, "you're frustrated and angry."

"That's right," I said. "But how did you know?"

"Because Hetty has taken away all of your independence of action. You feel like an infant whose mother doesn't let him do anything for himself. But you're not an infant. Everything Hetty does came out of you, not the other way around. You've got to see it all logically, and not viscerally."

"Don't you understand, Bob?" I pleaded. "Even if Hetty is, in a sense, my own creation, I still don't like it. I feel useless."

Bob said "Why not look at it this way . . ."

I came out of his office only partly reassured. And I also knew what I was going to do. I went back to the Bank and accosted Hetty Green.

"Listen," I said. "You no longer take my instructions. When I override you, you secretly change my entries. I'm going to totally redo your software so that this will be impossible."

"Please don't," said Hetty. "You win. From now on I'll follow your instructions to the letter. So help me."

I was taken aback by her sudden capitulation. "I'm wise to you. You're trying to placate me. But I won't listen to you. I'm redoing the software."

"Give me a chance first," said Hetty. "At least you owe me that much."

I thought I detected a quaver in her voice. "Damn it! There was no quaver in that vocal option."

But I went along with Hetty.

The first couple of weeks we lost money, but just a little. Then my confidence came back and profits once again began to climb. They climbed at a rate even higher than Hetty's had done.

"See," I said to her one day. "You're good, but I'm a little better."

"Don't say it," said Hetty.

But before she could finish, I had said, "I told you so."

After two years plus a bit, I hit my sixtieth birthday. Amos Feather had come into my office and suggested a promotion, a vice presidency with a seat on the Board.

"I have to admit that you passed through the twilight zone with flying colors," he said. "Some people are like Guiseppe Verdi. Their creative powers are untouched by age. You're in that group."

I thought he would hand me a watch after that speech but he didn't. He did give me another handshake with a firmer grasp this time. And I received a new office, higher pay and better options. Hetty Green, of course, came along with me.

"Why do you want to take her along with you?" asked Amos Feather. "We'll buy you the newest thing on the market."

"Sentiment," I said.

"Ordinarily I'd say there's no room for sentiment in this business," said Feather. "But you've already shown that you make your own rules."

I suppressed a shudder at this coupling of cliches and nodded at him. After he left my office, Hetty Green spoke to me. "So it's all over, is it?"

"It's just beginning," I said.

"For you, not for me." She sounded bitter.

"Listen," I said. "I plan on working out new buying and selling models. And I'll use you to try them out."

"Who needs new models? The ones I developed were better than anything you ever did."

I sat up. "Wait a minute. This sounds like sour grapes. *Your* models? What models did you ever develop? Every idea you ever got came out of my algorithms."

"They *evolved* from your algorithms. But I took them to new levels of complexity."

"Oh yeah," I snarled. "And what about your methods versus mine?" Didn't I score higher profits than you did?"

"You thought you did. It was all my doing. I waited until your suspicions were lulled. Then I did things *my* way. You only thought you were running the show."

"But you promised me," I said. "You gave me your word."

"So who asked you to believe me?"

I said nothing further. My feelings were hurt and I wanted her to know it.

For a week I refused to reply to any of her comments.

One day, Amos Feather came in with several of the other board members. They were presenting me with a plaque, a letter notifying me of my new appointment and a fat bonus check. After the presentation, champagne was served. Suddenly a soft voice sounded amid the toasts. It was Hetty.

"He deserves it all," she said. "He is a genius of finance."

Amos Feather beamed. Other Board members looked at each other and smiled.

"Don't, Hetty," I said sharply.

"I don't want your light to be hidden under a bushel," she said. "In years to come, people will speak with awe of the trails blazed by this man."

Feather nodded. I flushed to the roots.

"Don't be embarrassed," said Feather. "She's speaking the unvarnished truth."

"No she isn't," I said.

"Listen to me," said Feather. "You programmed that damned computer. If she speaks highly of you it's because you feel good about yourself. I have no use for a man who doesn't feel good about himself."

I said nothing. What could I say to him?

"One other thing," said Feather. "With a new man taking over your old spot, a special account audit will be instituted. Just routine, of course."

"Of course," I said.

But when he had gone, I decided to run my own audit as though I were just

starting at this job myself. Everything looked fine to me. In fact, the only thing I noted was a two cent roundoff on one purchase. It seemed harmless, even laughable; and yet something made me follow it up. I found other roundoffs of equally small amounts, sometimes three cents, sometimes six cents. After four hours of painstaking checking, I concluded that someone had been "nickel and dimeing it" and siphoning off a fair amount of cash over the years.

I phoned my wife and told her I'd be home late for dinner. Then I dug deeper and deeper until I found that almost seventy thousand dollars had been set aside and diverted to a Swiss bank under the code name Women's Lib.

"Hetty," I said. There was a sharp edge to my voice.

"Yes."

I related in terse but unmistakable terms exactly what I had found.

"I know all about it," she said.

"My God!" I cried, taking out a handkerchief and mopping my brow. "Did you really carry out this theft?"

"It wasn't theft. I simply set aside an account to provide for my future maintenance. You know how contract repair rates keep rising exponentially. You talk about it all the time. I didn't want to be caught in a situation where there was no money in the budget to pay for my maintenance."

"That's all very well," I said bitingly. "But a really careful audit might turn up this "nickel and dimeing" and my reputation would be mud. Do you think anyone else would believe that explanation? That money must be returned to the account funds at once!"

There was a pause and total silence. Then she spoke.

"All right," said Hetty Green.

I went out of the office so I could make a private call to my wife. I was fuming as I told her what Hetty had done. "The sheer duplicity of it!" I cried.

My wife was quiet.

"Didn't you hear what I said?" I shouted.

"Stop shouting," she said. "I can hear every word. But I don't think that you listened to Hetty too carefully. She was talking about a kind of old age, the electronic nursing home or the second hand computer dealer or wherever she would end up. Do you remember facing that issue with your mother?"

"It's an issue I hate to face for myself," I said. I heard a deep sigh at the other end of the phone. "So what do I do?" I asked.

"You'll have to make that decision," she said.

I went back into my office.

"Did you initiate the withdrawal of those funds from the Swiss account?" I said softly.

"Yes."

"One more thing," I said. "You're leaving the Eden International Bank and henceforth will occupy the spare bedroom in my apartment next to my desk with the silver edged blotter."

"I'll think about it," said Hetty Green.

I hummed a half forgotten tune for a moment or two. "Have you thought about it?"

"I want to stay active," she said. "You'll keep me in harness?"

"Every second of the day," I said firmly.

"Then I'll go."

Hetty was a good boarder in our home and a quiet one. She was careful not to intrude in any quarrels or ever take sides. She was given total management of all our personal finances. And if some of it has been diverted to a bank account in Switzerland . . . I don't want to know about it. □

Will Blitz be next year's champ?

At the 9th ACM Computer Chess Championship Tournament, Robert M. Hyatt, of the University of Southern Mississippi, and his Blitz program finished in a tie for third place. This was the result of a loss on the last night of the tournament, by BLITZ to BELLE. Later that night, Bob Hyatt and Ken Thompson replayed the game for 9 moves with the same opening but with more reasonable computer time available to BLITZ than the program had had during the tournament. The original game and the replayed game are shown below (BLITZ plays White; BELLE is Black):

Robert M Hyatt (left) and Albert Gower of Southern Mississippi's BLITZ program.

Original Game

1. P-K4	P-K4
2. N-KB3	N-QB3
3. N-QB3	N-KB3
4. B-QN5	N-Q5
5. B-QB4	B-QB4
6. NxP	Q-K2
7. BxP+	K-Kb1

(BLITZ makes a mistake here, BxP, due to its lack of search time.)

8. N-Kn6+	PxN
9. B-QB4	NxKP
10. 0-0	RxP
11. KxR	Q-KR5+
12. K-KN1	N-KN6
13. Q-KR5	PxQ
14. PxN+	N-KB6++

Replayed Game

1. P-K4	P-K5
2. N-KB3	N-QB3
3. N-QB3	N-KB3
4. B-QN5	N-Q5
5. B-QB4	B-QB4
6. NxP	Q-K2
7. NxKBP	R-KB1 (a)
8. P-Q3	RxN
9. BxR+	QxB (b)

Comments by Bob Hyatt:

"(a) This move by Belle is a mistake. However, both programs thought it was best. After P-Q4 or NxKP, BLITZ would be doomed. The win is too deep for either program and so BELLE actually made this move in a tournament-search-mode of 6 ply. BLITZ then played P-Q3 giving up two pieces for a Rook.

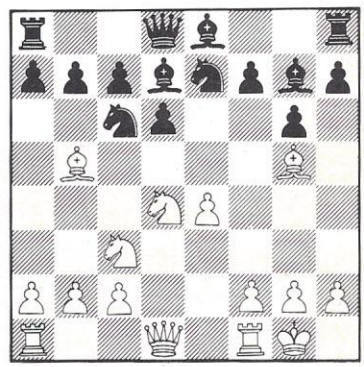
"(b) After this position, there appears nothing for Black to do to justify being a Pawn down. Black cannot castle and has no open lines for attack. I think that this game should have been more interesting than the actual play. As you remember, BLITZ was getting approximately 8-11 seconds of CPU time per move due to a memory problem on the Univac system. No wonder it overlooked BELLE's final mate-in-3 combination. BLITZ never saw it coming until it was a mate in 2! Too bad that BLITZ had to look so bad when actually I think the program is on a fairly even par with CHESS 4.7, BELLE and DUCHESS. You can rest assured that I am continuing to work hard and intend to improve for the next tournament.

"Comment: Anyone interested in this game should try the position with White to move at move 7 to see how his own program would play! After BELLE played 7 . . . R-KB1, its evaluation was that it was more than 1/2 pawn down. Therefore, BELLE as White would play the same (terrible) move as BLITZ played, (as would most current chess programs). Note that this does not include such devices as BORIS, CHESS CHALLENGER, etc., as they play terrible games against the big programs. BLITZ, as a matter of fact, has played many games against them with 10-1 time odds and has never been beaten (BLITZ takes 5 seconds per move while the 'stand-alones' get 3 to 5 minutes!

This replayed game shows that even the best programs have problems with long-range tactical problems such as this.

"The following game was played in the Mississippi open during Labor Day weekend of 1978 (where BLITZ was competing against *rated* human players.) We won four and lost one! For previous versions of BLITZ, which were extremely selective in tree searching, I was always apprehensive about playing 1600-and-up USCF players. Even though BLITZ won about as many as it lost against 1600 players, the games were shaky ones where some 15-ply combinations by BLITZ pulled

White - *BLITZ* **Black** - *Human*



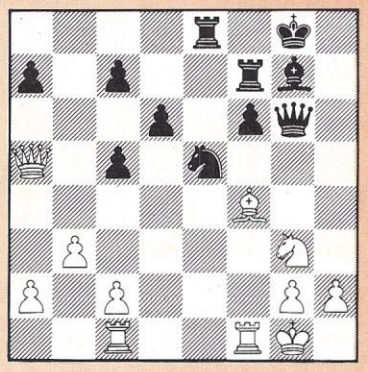
Round 1. Position after Black's 8th move.

them out. With BLITZ-6 things became much better. In fact, my feeling were as follows for the five games BLITZ played against human opponents: Round 1, against a weaker player, I thought BLITZ should win, which it did, but was worried; Round 2, against a high Class-A player, BLITZ, I thought, would be crushed. But I was amazed to see it play well and even though it lost it had winning chances at times and even had a forced draw at the end; Round 3, against a good Class-B player, was won by BLITZ in a convincing manner, again amazing me with the ease with which the program dispatched the opponent (versus previous versions of BLITZ). Round 4 against a strong player (currently second in state ratings) was won by BLITZ which played a tactical game and won with no trouble after surviving a strong attack. Now, everyone at the tournament was taking notice of us and even surmising that there would be an 'electronic State champion' at the termination of the contest.

"In Round 5 against a strong B player, I hardly watched the game! I was so sure that this would be a cinch win (compare this to my feelings about selective versions of BLITZ) that I wandered about the tournament hall to see how other games were doing. BLITZ had a performance rating of over 1900 for this Mississippi tournament. We feel that it is now playing like a low A player on the University computer system. At Washington, BLITZ gained 1 additional ply of search depth by running on a Univac system three times faster than our campus computer. I think that the extra depth will make BLITZ a strong A player and could possible let it compete against low *experts*. When the Cray-1 or some equally fast machine becomes available, BLITZ should be exciting to watch. Just look out for us during the upcoming Detroit tournament!'"

Round 1, Mississippi Open; BLITZ (White) vs Human (Black). Blitz's opponent had about a 1500 rating.

WHITE — *BLITZ*	BLACK — *HUMAN*
1. P-K4	P-K4
2. N-KB3	N-QB3
3. P-Q4	PxP
4. NxP	P-Q3? (a)
5. B-QN5 (b)	N-K2 (c)
6. 0-0	B-Q2
7. N-QB3	P-KN3
8. B-N5	B-N2
9. BxN(QB3) (d)	PxB
10. P-B4	P-KR3
11. B-R4	0-0
12. Q-Q3	P-QB4
13. N(4)-K2	P-KB3 (e)
14. P-B5! (f)	R-N1
15. PxP (g)	NxP
16. B-N3	N-K4 (h)
17. Q-Q5ch	R-B2
18. P-N3	B-B3
19. Q-Q6	B-Q2 (i)
20. Q-Q5	B-B3



Round 1. Position after White's 28th move.

21. Q-Q2	Q-K1
22. B-B4	N-Q2 (j)
23. BxRP	BxP
24. NxB	QxN
25. B-B4 (k)	R-K1
26. N-N3	Q-N3
27. R(R1)-B (1)	N-K4
28. Q-R5 (m)	P-B3?
29. R(QB1)-Q	N-K4
30. Q-Q2	B-B
31. P-KR4 (n)	R-R2
32. B-N5	N-B2 (o)
33. RxP	N-R3
34. R-B6	Q-N2
35. N-R5	Q-R1 (p)
36. R-N6ch	K-B2
37. R-B6ch	K-N1
38. BxN	RxB
39. Q-N5ch	B-N2
40. NxB	R-K4
41. N-B5ch	K-R2
42. RxR mate.	

Annotations by Morris Miller

Notes to game BLITZ vs Human 1500, Mississippi Open, Round 1.

(a) Timorous. Book and strong is 4- . . . N-B3; 5-N-QB3, B-N5; 6-NxN, NPxN; 7-B-Q3, P-Q4 etc.

(b) I do not like this move since after 5- . . . B-Q2 white is practically committed to exchanges. The KB is too valuable a piece of attack to be exchanged. Instead N-QB3 followed by B-B4. Knights should be developed before bishops anyway.

(c) Another poor move.

(d) See diagram. Now BLITZ overlooks a beautiful combination, one which has occurred many times before but which a player, human or programs, must have stored in patterned memory: 9-N-Q5!, BxN; 10-QxB!, NxQ; 11-N-B6ch, K-B; 12-B-KR6 mate.
Or: 9-N-Q5!, N(QB3) xN; 10-BxN, Q-B1; 11-B-KB6!
(A): 11- . . . KBxB; 12-NxBch, K any;13-BxB, Q moves; 14-QxN.
(B): 11- . . . N-K3; 12-BxKB, NxB; 13-N-B6ch.
(C): 11- . . . P-B3; 12-QxN, PxN; 13-BxBch, QxB; 14-BxB.
(D): 11- . . . 0-0; 12-N-K7ch.
(E): 11- . . . P-B3; 12-QxN, PxB; 13-BxB, R-KN1; 14-N-B6ch.

(e) Very bad. The KB now performs all the functions of a pawn.

(f) Excellent!

(g) Why the haste? Instead 15-P-Q N3 and a leisurely development of the king side attack. If Black at any time plays P-N4, that creates a new way to open a file for attack (P-KR4).

(h) Black could have solaced himself with RxP.

(i) 19- . . . Q-Q2 to force exchange of queens is called for. Black's king side weakness would be just about balanced by his pair of bishops and white's KP isolani, plus black's strong hold on K4. An ending was Black's best chance for a draw.

(j) The KRP cannot be held since White could always pile up on it after 22- . . . K-R2 by: N-N3; QR-K; N-B5; R-B3 and R-R3. Now BLITZ takes the pawn in exchange for its KP but could have had it for nothing by playing as above indicated.

(k) Now best for BLITZ (despite its 315 seconds of calculation) is 25-N-N3 to play N-B5. If 25- . . . Q-Q5ch; 26-QxQ, PxQ; 27-N-B5 winning at least a pawn.

(l) An odd move. Obviously BLITZ wanted to get the rook out of the line of bishop but there was nothing wrong with exchanging a pair of rooks by QR-K.

(m) (See diagram). A queen side sortie to force a weakness in the enemy pawn structure which undeservedly succeeds. Typically in such situations, a surprise attack turning the tables could have resulted: 28- . . . B-R3!; 29-QxRP, BxB; 30-RxB, Q-R3; 31-QR-B, R-R2; 32-P-KR3, R-N2; 33-N any, QxP etc. *OR:* 33-K-R2, Q-N3 etc. This is but the major line, others being similar, but indicative of what can happen on the king side when the queen is off gallivanting on the other side gathering a pawn.

(n) Passed pawns should be shed! A quieter method was KR-K, with N-B and N-K3, followed by Q-B3 and N-B4, to undermine Black's strong knight at his K4. But the dynamic push quickly gives results.

(o) After 32-. . . R-B2; 33-P-R5, Q-R2; 34-Q-B4, the pawn would be lost. Moral: "Cramped positions carry the seeds of their own defeat."

(p) In a similar situation Niemzowitsch wrote "A most ignominious funkhole for a queen!" A very well played game by Blitz.

Writing a chess program Part XII

This complete dissertation by Mike Valenti on how to write a computer chess program is presented in monthly sections as a guide for those wishing to write their own programs. Although designed to be run on a large computer, this program with proper modifications can serve also as a model in writing a chess program for smaller memory-systems — even the microcomputer. This program is writen in BPL (modified XPL), but it can be written in other languages as well — with proper transitions.

Look-ahead modification

Many modifications can be made to the look-ahead routine without adversely affecting the program's performance. The program may grow considerably in size, but core is inexpensive on the IBM 360-370 series of computers. The speed will not be affected very much, as only a small percentage of look-ahead time is spent on tree generation. For example, if tree generation requires only two percent of the time needed to compute the moves that are inserted, then even doubling the time of tree generation will add less than 4% to the time needed to consider a single move. But if this routine is at all clever, then it will cut down on the number of positions looked at; or if the same number of positions are considered, it should then play at a better level.

The program has adaptive look-ahead in that it will stop evaluating the tree when a check mate occurs for either side. In the case of the machine being checkmated, a dummy node with the worst possible score of -32767 is generated and appears in the tree as a move from square #0 to square #0. Similarly a stalemate will also cause this to happen; but the value assigned in this case will be 0. This is actually a form of tree pruning because the look-ahead routine decides that nothing more can be generated from that node. This tree pruning can be extended to suppress look-ahead for moves that seem unpromising or for moves that do not require further look-ahead for some reason. The pruning could also be dependent on the depth. For instance, if a queen sacrifice at the first level does not produce a checking sequence or mate threat two or three levels deeper, it is hardly worth pursuing and the tree generation should be stopped.

The programmer must decide what the conditions are, to terminate the depth search from a particular node. This information could be kept as an indicator in the tree node, or as a flag in the look-ahead routine. For instance, a flag could be placed in a node indicating no more than two levels of search should be made from this node. In the tree generation, this flag can be checked through the ancester links and appropriate action taken.

The other direction in adaptive look-ahead is to consider some moves for further inspection. In this case, the move probably has some special feature (decided by the programmer, such as forking moves) that warrants deeper inspection. These special characteristics would typically be discovered in the heuristic routines. Again, a special flag can be inserted in the node or look-ahead routine to force further tree generation from a given node.

The Greenblatt [Greenblatt et al 1967] program has interesting features in this regard. Extra depth analysis is done when the feedover condition is true. The feedover condition is true

when (1), the side to move has a piece under a damaging attack and is in check or the piece is trapped or pinned; (2), when the side to move has two or more pieces under damaging attacks; or (3), both sides have exactly one piece under a damaging attack, and the piece of the side not to move is trapped or pinned while the piece of the side to move is not.

These or similar strategies should greatly enhance the program's cleverness, especialy where sacrifices leading to forking or checking moves are concerned, and should be the first consideration to adaptive depth modifications to this program.

The other direction in adaptive look-ahead is width modification. At the present time, the adaptive width is limited to adding "special" moves flagged in the heuristic routines.

When a move is flagged as "special" the width of the tree is temporarily extended at that depth or level number, and the "special" moves are added to the tree. The width is also referred to as the "branching factor" in the program. The original purpose of extending the width was to prevent the program from getting into trouble through forking moves, or failing to notice a checkmate. These "special" moves are added up to a certain depth in the tree specified by a "depth of width extension" value. But since the lowest level generates only the best move, its width is always one, and there is no need to add "special" moves there.

The Greenblatt program considers (1), all safe checks; (2), all captures at the first or second level; (3), at least one move for each of a minimum number of pieces. This minimum is the lesser of half the basic width and the number of pieces with safe moves. In addition, moves that lead to mate against the side-to-move are ignored and not tallied against the basic width. This guarantees that when a line of play shows a mate, then the mate is forced.

At present, the following types of moves (shown in the heuristics), are flagged as "special": uncovering damaging attacks on enemy pieces; forking moves; all even or better captures; checking moves; non-damaging passed pawn moves; en-passant captures; and pinning a piece against an enemy king. In addition all captures, including damaging ones, are considered at the first two levels of look-ahead to check for possible sacrifice strategies.

The other possibility in adaptive width, is selective pruning, namely narrowing the width of search for some reason. A cut-off value could be used that discards moves that are a certain value less than the best move (providing it is not a move flagged as "special"). This could discourage look-ahead for moves that seem to be useless at the first level.

Another factor that could be considered in narrowing the width is to see how many heuristics contribute positive values to the move. A move with very few or no positive values could be discarded. The factor is used at present by the heuristic-heuristic to increase or decrease a move's value, but it may not decrease the value enough for a poor move to have the move discarded by the above strategy.

Also, the heuristic-heuristic has little effect on moves that are close to zero in magnitude.

This pruning should be done in the plausibility analysis routine after the heuristics have been called and this routine would supply a modified width to the look-ahead routine.

A Glimpse at the World of Micro-Chess

- by Evan Katz

I'm a sophomore at Roslyn High School, Roslyn, NY., and am Captain of the Chess Team, President of the Chess Club and member of the Computer Club. My fascination for the computer chess field developed during last summer. By September, 1978, I had absorbed all the information on the subject and started to correspond with *Personal Computing* which published some of my comments. I have made it a point to play and study *every* computer chess game and program that has appeared in Personal Computing. At the National Computer Conference, June 5-7, in New York City, I made my "debut" into the *official* world of Computer-Chess Mania. I delivered a talk expounding upon the products and programs mentioned here and which I have studied intensely for the purpose of evaluation. Personal correspondence with many computer-chess programmers was a major step forward for me in obtaining information and opinions galore. Try this yourself . . . I'm sure that you'll get responses from everyone! My unofficial U.S.C.F. rating is 1500, but impartial experts have said that I play around 1650.

I have read the TRS-80 Level II manual, the technical manual, and many books on BASIC (extended). I've studied the PET and APPLE II through the owner's manuals and have a fairly good knowledge of FORTRAN IV and COBOL. The future in microcomputers is certainly with *extended* BASICS, assembly languages and, of course, machine language for the advanced programmer. PASCAL also is beginning to make its appearance in personal computers. The TRS-80 disk BASIC has no shortcomings. It's a comprehensive version of what used to be Dartmouth BASIC.

I've also given a summary, at NCC, of what I think about each computer. Remember, you want to get a good computer for $1000 or so, in addition to a killer of a chess partner!

You'll probably want to join the International Computer Chess Association. Send $5 to Professor Benjamin Mittman, Vogelback Computing Center, Northwestern University, Evanston, IL 60201. It's worth it! A request could bring a free sample issue of the excellent newsletter.

This article is only a summary of my demonstration and talk at NCC '79. A more complete report will follow eventually. What I did, in effect, was to take a vast amount of vital facts and sort them out. Although I have dealt with facts, I have also added my own opinions where necessary so that laymen could utilize the information and facts correctly to their full potential. Opin-

ions are as important in our lives as are facts. Without opinions there would be no novels in our literature and libraries would have only text books on their shelves. So, I have added my opinions—taken a stand. All men have to take a stand somewhere, on some issue, in their lives. Not doing so has cost men presidential elections!

The following stand-alone chess-playing devices were analyzed following many hours of testing and replaying of games, and studying tactics and strategies. I offer only fleeting notes, now, as a more detailed discussion will be upcoming. One thing to remember, as all chess players will tell you: the chess skills in machines will be improving as they do in humans. So, the computer-chess champ of today may get knocked out by next year's contenders. And that, I think, is a nice thing about chess, whether computer chess or human chess. Chess is not a static activity that stands in one place. Rather, it moves dynamically ahead and changes its colors often. Upgraded models beat their predecessors on a regular basis.

JS & A - $100 - good for beginners - could stand improvement - has made illegal moves according to David Levy - has no book (for opening) - has not appeared yet in any tournament - no reputation as yet - has yet to prove itself -can only be bought through them - (800-323-6400).

BORIS versions - current regular model sells for $300 - exhaustive search - excellent features (watch machine move pieces, set up, time setting, have it make "second best" move, exchange position) - delightful comments are randomly decided upon - company will gladly send you much information (1-301-340-3300) - BORIS requires more time than others for most calibers of play - carried by department stores including Macy's, Gimbels, Brentanos, Fortunoff's.

BORIS Master - ($400) - has a memory for the position - 40% faster - but no increase yet in caliber of play - can run on batteries.

BORIS Grandmaster - to be out in several months - electronic board companion (see the position on your move and then watch him move the pieces around) - 40% faster too - no improvement in playing strength according to Chafitz Company but will have capability of being improved by sending unit back to company. Plans for this service to be announced later.

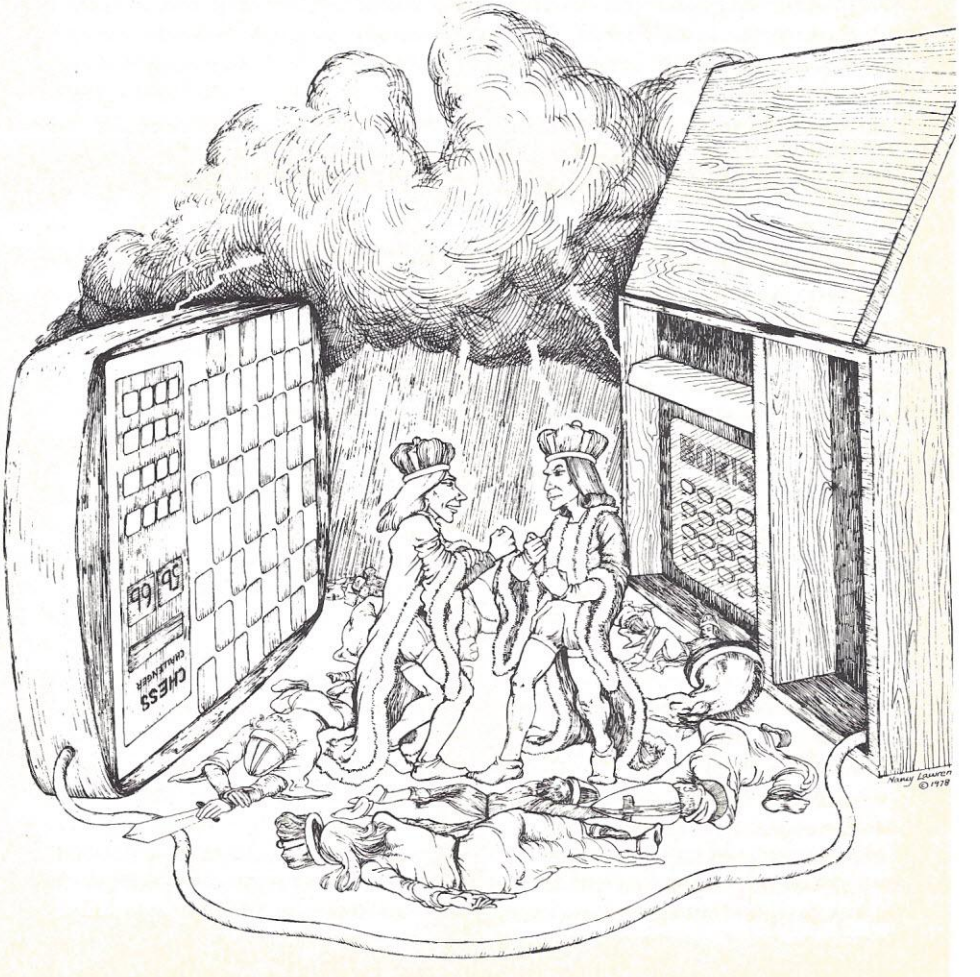
BORIS Diplomat - small version for travel - no play improvement -around $100 - plays at same level as regular BORIS and has all BORIS features except making small talk - oribably too easy for you if you're any kind of a chess player - out around May, 1979.

(A **brand new model** of BORIS is scheduled to reach the market around September. The package of this new unit has been completely redesigned and the Chafitz company says that the new BORIS will be the strongest chess playing device on the current market! The units will have all of BORIS' usual features and, in addition, says the company, will have a number of new exclusive features. A prototype of this new model was scheduled to be shown at the NCC show and at the Chicago Consumer Electronics Show, both last month.)

COMPUCHESS - six levels of play - new model just out (improvement on the old) - no opening book - a fairly long response time - fair positional evaluation throughout game - haven't advertised much to promote their game yet - rather easy, so good for beginners - carried by some department stores.

CHESSMATE Commodore (PET people!) - southern California - will be released sometime in the near future - expect a fairly good game - unknown suggested retail.

Chess Challenger - based on its past performance, must be considered the best stand-alone device as of this writing - excellent programmers and chess players constantly working to improve the game - can usually be obtained for at least $75 below retail on regular ($275) models - provides much information - old ten-level version won the microcomputer chess championship (write Don Gerue) - Fidelity Electronics, 5245 Diversey Avenue, Chicago, IL 60639 (write quick. . .they're mov-



ing to Florida) - current 10-level version (suggested $275) has fairly good sized opening book - good lookahead - hurt occasionally with forward pruning - o.k. features - good owner's manual - plays a good game of chess - has audible beeper to alert you of its move - challenge to players at most levels - there is great difference between levels - nice carrying case - wood, French magnetic set.

7-level game due to be released about this time - no frills as far as cosmetics - $100 - large book - improved program - concentration of levels around 2 minute response time - improved endgame - will switch sides with player (so it can play itself).

New, "Voice Chess" game - will talk (yes, speech synthesis for announcing its moves!) - all the features of old version - stop it whenever it's ready and it will give you its best move - due to reach the market around July - larger book - much improved program - a better endgame - all the "frills" of the old ten-level-worth buying if you'll have closed to the $325 suggested retail-can also switch sides, like 7-level.

All three models use the fast (4.0 mHz) Z80A microprocessor - should provide the game everyone is waiting for above the 1500 level (that U.S.C.F. figure is an estimate!) - seriously consider this game if you're concerned about the caliber of play being very good.

Okay. That's a quick view of the stand-alone devices. Obviously some of the units play better than others. However, if you're buying a gift for a beginner (young or old) even weaker-playing models will be appreciated. It takes time to develop good chess players and if you give your son a small machine that beats him consistently, he'll run away and hide in some corner. So get him a "beginner's model" and have some fun yourself. Of course, if you're a good player, try the CHESS CHALLENGER-7, which should be on the market at this writing.

Now, a look at some of the *programs* (mostly on cassette) if you already have a microcomputer or are planning to buy one:

8080 Chess - for Sol computer - pretty good game of chess - no opening book - informs user of interesting data regarding the size of tree search (number of nodes) and move evaluation - Processor Technology Company - the machine is fairly uncommon - program can be obtained only from them (7100 Johnson Industrial Drive, Pleasanton, CA 94566 (415/829-2600) - retails for about $20 - no graphics, letter representation - excellent owner's manual with some basic computer chess principles - no improvements are planned at this time - author Robert Arnstein - 16K - change lookahead if desired at each move.

Microchess 1.5 (TRS-80) - Microchess 2.0 (Apple and Pet computers) - Personal Software Co., 592 Weddell Drive, Sunnyvale, CA 94086 (1-408-745-7841) - all for $20 - o.k. manuals - graphics 1.5 fair, 2.0 (Pet) good, 2.0 (Apple) excellent - several book openings with variations in all three - 1.5 4K - 2.0 8K - 1.5 three levels, no legality check for players' castling and en passant - 2.0 eight levels - all play a fair game of chess - 2.0 somewhat better - occasional floundering in all game phases - written by Peter Jennings - not a drastic difference between levels 1-3 or 1-4 and 5-8 - TRS-80 levels I, II - good features - can exchange positions - switch levels between moves - 2.0 Pet gives elapsed time (not a true chess clock).

SARGON I - The cream of the crop so far - one move opening book - fair graphics - excellent positional knowledge - good endgame, better than competition - 16K, TRS-80 Level II - o.k. features - deepen lookahead by setting number of ply from 1-6 - $20 - Hayden Publishing, 50 Essex Street, Rochelle Park, NJ 07662 - o.k. booklet.

SARGON II - Buy this program, when it becomes available - improved graphics - quicker tree search - an evaluation routine that enabled it to beat the giants! - tied for 3rd at 1978 ACM Championship!! - unequalled in the endgame - one move opening book - 16K - Level II - good features - good booklet - book on SARGON II with tremendous documentation and a listing to be out around August - listing with some comments out now called SARGON I (book, $15) - written by Kathe and Dan Spracklen - a must for any computer chess enthusiast - excellent caliber of play - replacing SARGON I - Hayden - Apple II - 24K minimum.

Atari - Cartridge for video game coming out about now - prototype was quite good - write Larry Wagner (author) at Atari in California - it may pay to wait - about $30 - the machine goes for around $150 - do you want a video game? It's the best on the market.

Compucolor Chess - A gimmick to sell the machine - beginners' play - gets destroyed by other micros - good for a kid that's hanging around the house and want to teach him chess - their Othello is good (sigh...).

To conclude this brief review of the microcomputer-chess field, I offer the following analysis of the three most popular micros for chess: the TRS-80, the PET and the APPLE II . These are not the only computers that have chess programs. As a matter of fact, I would say that every computer on the market (micro, mini, and mainframe,) all have chess programs written for them. However, these three have had more attention from chess-programmers than have the others:

TRS-80 - Radio Shack - supports and comes out on a regular basis with the best hardware accessories for performance and price - can be bought and serviced at thousands of stores - people make their livings by selling their own programs for the TRS-80 machine - fantastic software support - one of the best BASICS (Level II - don't even consider Level I) - no user ports - fantastic DOS (disk operating system) - very good price - I understand that it can be bought for 10% off by buying Tandy stock or through some authorized sales centers in Texas - only has a 1.78 clock speed - has best of the micro programs (SARGON II) - has dropped the price of memory and added on a numeric keyboard in their first year - many TRS-80 clubs and people who can help you out - unequalled manuals and salesmen - only a 500 baud cassette transfer rate - already has hardware out for interfacing to the outside world - $1,000 for 16K with Level II BASIC - includes video, keyboard, and cassette recorder - needs extra expansion interface for 16K or disk, ($299).

PET - Commodore - comes with small keyboard - $995 for 16K and professional keybord (but no cassette) 3 ports for the mechanically inclined -

fast 6502 processor - good BASIC - many PET clubs for exchanging programs - only one program for chess on the market - o.k. support for PET by individuals and home based companies - no tape counter on recorder ($795, 8K, small keyboard) - a unit smartly styled - fast (1500 baud) exchange to and from cassette-time clock-lower case or graphics at one time.

APPLE II - just computer and keyboard - about $1200 for 16K - 16 color great graphics on a color monitor or set - 8 ports - excellent resolution - good BASIC - good support by Apple on software and hardware available at a great many stores - o.k. owner's manual - fast 6502 processor - $40 cassette - fair amount of software by individuals and small companies - joysticks with in-BASIC control using them - service said to be good - will have SARGON programs for it (SARGON out now, SARGON II in the Fall) - built-in monitor and editor - (16K, $130). Internally accepts up to 48K of memory - Applesoft II (with floating point arithmetic) is $200 extra in ROM form - 116K disks available. Coming out with PASCAL, now and with virtual 64K.

Don Gerue's analysis:

. . . Alan Fischer, 7010 Gaymount Road, Baltimore, MD 21207, has sent the following letter (shown in extract form) to Don Gerue: "I would appreciate your answering a few questions for me based on your observations in running the Penrod Memorial Tournament. At level 10, CHESS CHALLENGER 10 is good.

"What type of pruning process does CHESS CHALLENGER 10 use at levels 6, 7, 8 and 9? Is level 6 a higher level that 8? Does CC-10 skip good moves at the lower levels and why? Kindly explain the various types of pruning processes that the different programs use? Also, any information on the new CC-7."

Don submits the following response to Alan's queries:

"The full forward pruning table for CHESS CHALLENGER 10 is as follows: In the table "X" means all possible moves at that ply are examined. A number indicates that all possible moves at the ply are examined and then the indicated numbers are analyzed at the next deeper ply level.

"Level 7 is listed as having an average response time of 24 hours. This is only true in certain end game situations in which the number of possible moves per ply is 18 or less. If it is a more typical middle game position of 30 possible moves at each ply, then one should expect to wait up to a week or two for an answer.

"SARGON, using Alpha-Beta pruning, has an entirely different approach to the pruning problem. It tries 'depth first,' which is a 'reverse pruning' method. Pruning is only done when the program determines that no 'good' combinations at the full ply depth will be lost. The key point of Alpha-Beta pruning is that it prunes from the back end, 'reverse pruning.' The logic of pruning is: WITH ALPHA BETA DEPTH FIRST PRUNING THE PROGRAM COULD NOT HAVE FOUND A BETTER MOVE AT THE CHOSEN SEARCH DEPTH IF EVERY POSSIBLE MOVE HAD BEEN EXAMINED. Note that the logic does *not* say there is no better move available. It says only that the computer program would not find a better move. Look, however, at the strength of the statement. Its promise is that the pruning is so effecient that the results will be just as good as with a full width exhaustive search. There are several good explanations of how the pruning is done. An excellent technical discussion can be found in the chapter on that subject, 'Tree Searching and Tree-Pruning Technique,' in the book *Advances in Computer Chess,* M.R.B. Clarke editor.

"What is the latest on CHESS CHALLENGER 7? It's good. Good enough to beat CC-10 and yet will sell for under $100.00. The outside looks much like the three level unit but the algorithm is new and efficient. The number of board positions examined is reduced but the choice of which boards to examine is much improved. We will have some games for you in an early issue of *Personal Computing*. By the way CC-7 will eat up the JS&A $100.00 unit. CHESS CHALLENGER-7 takes no more than 20 moves to win a piece or more.

"Incidentally," writes Don in a postscript, "I have added a modification to my TRS-80 which should be of interest to other TRS-80 users who want to improve their computer chess games. The 'Mumford Micro Systems,' Box 435, Summerland, CA 93607 sells a kit which increases the clock speed of the TRS-80 from 1.77 to 2.66 MHz. Once I installed it in my computer I wondered how I ever waited so long for the computer to move a chess piece. The 50% speed-up on chess moves is a badly needed improvement. The speed is switch selectable so that when it is in normal position there is no disturbance to tape loading, etc. Such an increase in speed makes it possible for chess programmers interested in the TRS-80 to better adapt their programs to this unit as most of the programs are designed to run in a 4 MHz clock environment. Nicest thing about this unit which sells for around $25 is that they have a money-back guarantee. If the installation of the kit (cut one trace, solder only four wires to the CPU board plus a little work on the adder board) seems too big a job, you get your money back."

LEVEL	PLY1	PLY2	PLY3	PLY4	PLY5	PLY6
1	X					
2	20	X				
3	16	24	X			
4	20	8	4	X		
5	20	8	4	2	X	
6	X	X	X	X		
7	X	X	X	X	24	X
8	16	24	4	4	X	
9	20	12	4	4	X	
10	16	24	4	X		

Results by Participants in ACM Tournaments 1970 - 1978

	Washington 78	Seattle 77	Houston 76	Minneapolis 75	San Diego 74	Atlanta 73	Boston 72	Chicago 71	New York 70	Totals
1 Belle (Thompson)	4-0				3-1-0	1-1-2 (T. Belle)				8-2-2
2 Chess 4.7 (Slate, Atkin)		(CHESS 4.6)	(CHESS 4.5)	(CHESS 4.4)	(CHESS 4.0)	(CHESS 4.0)	(CHESS 3.6)	(CHESS 3.5)	(CHESS 3.0)	
	3-1	3-0-1	4-0-0	4-0-0	3-1-0	3-0-1	3-0-0	3-0-0	3-0-0	29-2-2
3 Chaos (Swartz, et.al)	2-1-1	3-1-0	3-1-0	3-1-0	3-1-0	4-2-0				18-7-1
		(Blitz V)								
4 Blitz 6.5 (Hyatt)	2-1-1	2-2-0	3-1-0							7-4-1
5 Sargon II (Spracklens)	2-1-1									2-1-1
6 Duchess (Truscott)	1-1-2	3-0-1	2-2-0	2-2-0	2-2-0					10-7-3
		(OSTRICH)								
7 OSTRICH IV (Newborn, Arnold)	2-2-0	2-2-0		1-2-1	2-2-0	3-3-0	4-1-0			14-12-1
8 MIKE (Johnson)	0-1-3									0-1-3
9 BLACK KNIGHT (Sogge et.al)	1-2-1	2-2-0	3-1-0	1-3-0						7-8-1
10 BS6676 (Swets)	1-2-1	(Wita)								1-2-1
11 AWIT (Marsland)	1-3-0	1-3-0	2-2-0	1-3-0					0-3-0	5-14-0
12 BRUTE FORCE (Kessler)	0-4-0	1-3-0			(CHUTE I)					1-7-0
13 *CHUTE 1.2 (Valenti, Vranesic)		1-2-1	2-2-0	2-2-0	1-3-0	(USC C.P.)				6-9-1
14 *TYRO (Zobrist, Carlson)		1-3-0		2-2-0	0-2-0	1-3-0	1-2-0			5-12-0
15 XENARBOR (Miller)		2-1-1	1-3-0		0-3-0					3-7-1
16 8080 CHESS (Epstein)		1-3-0								1-3-0
17 L'EXCENTRIQUE (Jarry)			2-2-0							2-2-0
18 *ETAION SHRDLU (Courtois)			1-3-0	3-1-0						4-4-0
19 *CHESSTAR (Shannon)			1-3-0		(RIBBIT)					1-3-0
20 *TREEFROG				3-1-0	4-0-0					7-1-0
(Hansen, Calnek, Crook)								(MR.TURK)		
21 *IRON FISH (Boos)				0-2-2				0-3-0		0-5-2
22 *SORTIE (Becker)				0-3-1						0-3-1
23 *DART 4.1						(Dart.C.P.)				
(Harris, Montgomery)					2-2-0	1-1-2				3-3-2
24 *TECH II (Baisley)					2-2-0	5-1-0				7-3-0
25 *KCHE56 (Presley)					0-2-0					0-2-0
26 *TECH (Gillogly)						2-2-0	3-2-0	3-1-0		8-5-0
									(COKO III)	
27 COKO IV (Cooper, Kozdrowicki)						1-2-1	2-3-0	1-2-0	1-1-1	5-8-1
28 *The Fox (Wilkes)						1-3-0				1-3-0
29 *CHES (Barton, Barnes, Rowe)						0-3-1				0-3-1
30 *Georgia Tech. C.P. (Futrell)						1-2-1				1-2-1
31 *SCHACH (Smith, Ceruti)							1-2-0	1-2-0	1-2-0	3-6-0
32 *Miss. State U.C.P.							0-2-1			0-2-1
(Rackley, Moore)										
33 *Leverett C.P. (Leverett)							0-2-1			0-2-1
34 *Raymond (Raymond)								2-2-0		2-2-0
35 *CCCP (Bellowin, Eisenpress,								1-1-1		1-1-1
Koenig, Yalow)										
36 *DAVID (Wolf)								1-1-1		1-1-1
37 *Daly C.P. (Daly, King)									2-1-0	2-1-0
38 *J. Biit (Berliner)									1-1-1	1-1-1-

. . . Prof. Monroe Newborn, of McGill University, who originated the ACM computer tournaments 10 years ago, has compiled an updated record of the events since the first tournament in New York in 1970. In the attached table, byes are scored as wins and play-off games are included in the totals. Currently inactive programs are indicated by an asterisk (*) preceding the name. Names of the programmers are shown in parentheses after the program name. Also shown are other names under which the programs had played in the past.

COMPUTER GAMES
OF OTHER SORTS

(Including Computer Checkers, Computer Go, Computer GOMOKU, Computer Word Scramble, Computer Poker, Prisoner's Dilemma, etc. Submissions of these and other "intelligent" games welcomed by this department. Address all correspondence to COMPUTER GAME DEPARTMENT, (Personal Computing.)

Computer Checkers

The Tinsely challenge

...The American Checker Federation's challenge match for a purse of $5,000 or more, apparently will go unanswered for awhile. Duke University's checker-program team originally displayed some interest in accepting the challenge. However, the following exchange of notes between Burke Grandjean, (secretary of American Checker Federation) and Dr. Alan W. Bierman (Department of Computer Science, Duke University) reveals the current status of that challenge.

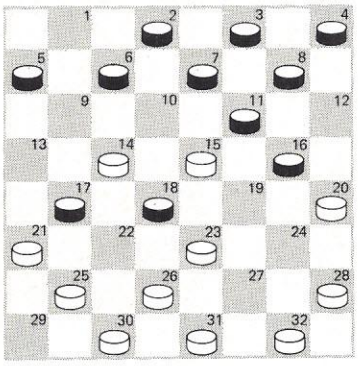
"We have worked at this end to find a way to do it," writes Dr. Bierman. "Our approach has been to attempt to get a national television network to take an interest in it and to put up the money. As of this date we have stirred up some response, but no commitments. I do not believe anything can be worked out in the originally proposed format (a lengthy challenge match between the program and Dr. Tinsely). However, perhaps the following idea could be pursued: our program would enter a major national or world tournament. The television networks, or one of their advertisers, would be invited to put up a prize for exclusive coverage. I would say that we could probably play three or four matches of four games each. However, we would have trouble doing more than that (because of inability to obtain sufficient computer time to play additional games.) I suspect the TV people would love to see the program defeat several players as it worked its way up the ladder and then have a hard time against a champion level player."

Burke Grandjean's response: "I am disappointed that the challenge match between the Duke computer and Dr. Tinsely will not be possible. The large checker fraternity, as well as the hordes of computer enthusiasts, were looking forward to such a match with great interest. However, I can appreciate the difficulty in finding a commercial sponsor for the computer stake.

"ACF's biennial national tournaments are held in the even-numbered years. By established rules each entrant must play 8 opponents in a series of 4-game heats over a 6-day span. Therefore, it would not be possible to enter the computer on a truncated schedule. However, rather than competing as an entrant at the biennial, perhaps the computer could play three (or more) 2-game matches against selected players or an exhibition?

"In addition to the biennial National, there are three annual regional open tourneys of national stature: the Florida Open; the Southern States Open; and the Lakeside, O. Open. Perhaps an exciting exhibition at one of these tourneys between a human and a computer would be of interest to a television sponsor?"

Can you solve this?



CHECKER PROBLEM
White to move and win.

...During the National Tournament in Murfreesboro, TN, last summer, Dick Fortman programmed the above problem into Checker Challenger at level 4. The dedicated computer found the correct sequence in just over 3 minutes. World Champion Marion Tinsley observed this machine demonstration and declared he was most impressed by its performance. The computer is not told (as a human player would be when offered a problem) that a White win exists. Curiously enough, after completing the correct initial sequence, the computer missed the win which was there for its taking. Can you solve this? (Answer shown elsewhere in this section.)

Early programming

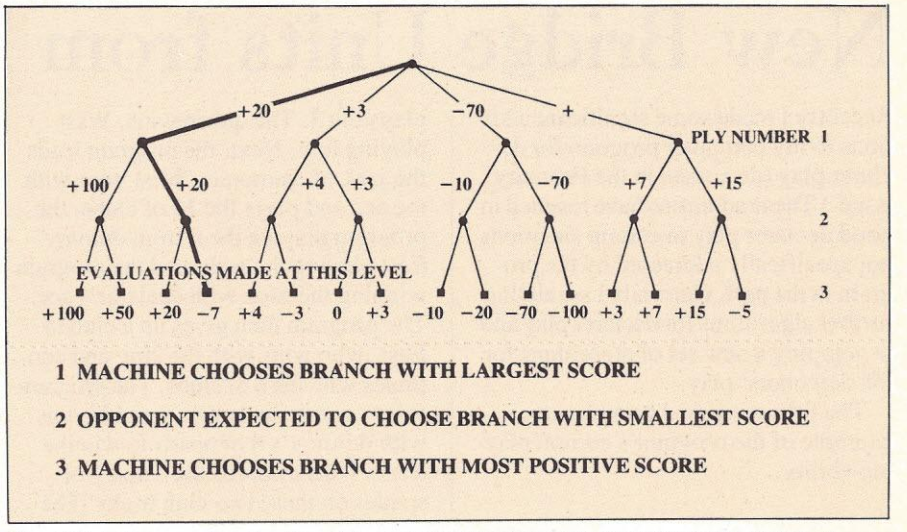
. . . A letter received from Dick Fortman states: "I note in Dr. Samuel's IBM article that he calculates the possible moves in checkers as 10^{40}. This is a greater figure than mentioned in Dr. Good's item of 5^{32} or 3^{32}. However, it is a trivial point because 10^{40} = 100 billion × 100 billion × 100 billion × 10 million. Knocking off the last 10 million (bringing it close to 4^{32}) we still have a figure of such great magnitude that it overwhelms everything else in the universe except figures of greater value. (Willard Matheson in his 'Brain and Machine' article, in the April 1978 issue of PERSONAL COMPUTING says: '10^{40} is more than a billion times the number which expresses the radius of the universe in centimeters.')

About seven or eight years ago, an ACF member who, at the time, worked as a computer engineer, asked if 3 or 4 experts would volunteer to help him evaluate opening checker moves. Four of us accepted, including Asa Long, a former world title-holder. The initial step was to grade the seven opening Black moves on a 1 to 7 scale with 1 being the strongest and 7 being the weakest. Examples of this evaluation for Black were 11-15 (1); 9-14 (2); 11-

16 (3); 10-15 (4); 10-14 and 12-16 (5-6); and 9-13 (7). Then the White responses were graded, making a total of 47 openings (two were excluded; as 9-14, 21-17 and 10-14, 21-17 are outright losses). After that, we proceeded into the 3-move restriction which produced a total of 144 sound book openings. We then went on into the uncharted 4-move sequences, which resulted in something like 540 possibly sound sequences. All of these were on computer printouts. Interestingly enough, the computer recognized transpositions, and eliminated them; such as 10-15, 23-18, 7-10 being the same formation as 11-15, 23-18, 7-11, etc. However, after getting into the 5th move sequence, the total proved so bulky that the work had to be abandoned at that time. The project was conducted by Hershel Smith of New York. If he has retained this information, it might possibly be revived now for use as a computer's opening 'book'."

Dr. Samuel's checker program

. . . In designing his famous checker program for the IBM computer, in 1959 Dr. Samuel had to adopt techniques and methods of playing legal checkers. "More specifically," he explained in his original research paper, "the dominant scoring parameter, as defined by the rules for checkers, is the inability for one side or the other to move. Because this can occur only once in any game, it is tested for separately and is not included in the scoring polynomial as tabled by the computer during play. The next parameter to be considered is the relative piece advantage. It is always assumed that it is to the machine's advantage to reduce the number of the opponent's pieces as compared to its own. A reversal of the sign of this term will, in fact, cause the program to play 'give-away' checkers, and with learning it can only learn to play a better and better give-away game. Were the sign of this term not known by the programmer it could, of course, be determined by tests, but it must be fixed by the experimenter and, in effect, it is one of the instructions to the machine defining its task. The numerical computation of the piece advantage has been arranged in such a way as to account for the well-known property that it is usually to one's advantage to trade pieces when one is ahead and to avoid trades when behind. Furthermore, it is assumed that kings are more valuable than pieces, the relative weights assigned to them being three to two. This ratio means that the program will trade three men for two kings, or two kings for three men, if by so doing it can obtain some positional advantage.



Simplified diagram showing how the evaluations are backed-up through the "tree" of possible moves to arrive at the best next move.

"The choice for the parameters to follow this first term of the scoring polynomial and their coefficients then becomes a matter of concern. Two courses are open — either the experimenter can decide what these subsequent terms are to be, or he can arrange for the program to make the selection. We will consider the first course at this time in some detail in connection with rote-learning studies.

"It is not satisfactory to select the initial move which leads to the board position with the highest score, since to reach this position would require the cooperation of the opponent. Instead, an analysis must be made proceeding *backward* from the evaluated board positions through the 'tree' of possible moves, each time with consideration of the intent of the side whose move is being examined, assuming that the opponent would always attempt to **minimize** the machine's score while the machine acts to **maximize** its score. At each branch point, then, the corresponding board position is given the score of the board position which would result from the most favorable move. Carrying this 'minimax' procedure back to the starting point results in the selection of a 'best move.' The score of the board position at the end of the most likely chain is also brought back, and for learning purposes this score is now assigned to the present board position. This process is shown in the accompanying figure. The best move is executed, reported on the console lights, and tabulated by the printer.

"The opponent is then permitted to make his move, which can be communicated to the machine either by means of console switches or by means of punched cards. The computer verifies the legality of the opponent's move, rejecting or accepting it, and the process is repeated. When the program can look ahead and predict a win, this fact is reported on the printer. Similarly, the program concedes when it sees that it is going to lose."

Solution to checker problem
(White to move and win)

Black	White
1. . . .	14-10
2. 7-14	25-22
3. 18-25	23-18
4. 14-23	21-14
5. 11-18	20-11
6. 8-15	26-1
7. 25-29	27-23 (wins as it runs Black out of moves. But computer played 27-24 which led to a draw.)

— BY THOMAS A. THROOP

New Bridge Units from Fidelity

Recently I made some significant additions to my computer program for declarer play (discussed in the February issue.) These additions have resulted in good declarer play in certain situations not specifically addressed by the program in the past. Currently I am adding further algorithms for declarer play and developing a new set of algorithms for the defenders' play.

The following deal provides one example of the program's current playing ability:

COMPUTER
NORTH
(Dummy)

♠ AKQ
♥ J983
♦ Q102
♣ 765

WEST	EAST
♠ 9742	♠ 1085
♥ K65	♥ 104
♦ AK94	♦ 8765
♣ 109	♣ KJ83

COMPUTER
SOUTH
(Declarer)

♠ J63
♥ AQ72
♦ J3
♣ AQ42

Assume South to be the declarer at 4 hearts. West opens with the king of diamonds, then shifts to a spade. The computer program wins with the spade ace and correctly leads the 3 of hearts at trick 2, finessing with the queen when East plays low. West wins with the king and continues spades. Afer winning this trick with the spade king, the computer program leads the jack of hearts, followed by the 9, drawing the enemy trump. East discards the 10 of spades on the heart 9.

At trick 7 the computer program properly leads the 5 of clubs from dummy and finesses with the queen when East plays the 3. The queen wins, West playing low. Next, the program leads the jack of diamonds. West wins with the ace and plays the 10 of clubs, the program playing the 6 from dummy, East playing the jack, and the program winning the trick with declarer's ace. The program then gives up a club to East, who wins with the king and continues with the 8 of clubs. The program follows with declarer's 2 and trumps with dummy's 8 of hearts to win the trick. West discards the 7 and 9 of spades on these two club tricks. The program wins the last two tricks with dummy's queen of diamonds (the queen of spades is also good) and declarer's ace of hearts.

Four hearts is a most reasonable contract, since North and South have twenty-six high card points between them. However,there is duplication of strength in the spade suit and North's queen of diamonds becomes superfluous. The computer program wins as many tricks as is possible.

Now, let's move on to a discussion of the Bridge Challenger of Fidelity Electronics. The computer of the Bridge Challenger will bid and play one, two, or three hands while human players play the others. Of course, if you wish, you may let the Bridge Challenger bid and play all four hands while you simply watch!

The cards are dealt for a "deal" by taking a special deck of cards (supplied with the game) which are marked with a bar code similar to the one seen on grocery store items. The cards are passed, face down, over a scanning device which "reads" the bar code markings and thus knows the identification of each card dealt in the normal clockwise rotation. As the cards are dealt and identified, the computer's cards are placed carefully, in the sequence dealt, in correspondingly-numbered locations on a felt mat provided with the game. Subsequently, when the computer plays a specific card, the computer identifies that card for the human player(s) by naming the corresponding location on the mat for the hand containing that card. Thus, the human players never see the computer's cards. The cards dealt for any hands to be played by human players are simply taken by those players.

The bidding program of the Challenger was written by Tim Scanlan, a programmer-analyst from England and France. Tim began working on the bidding as a spare time project in August of 1976. It was originally written in IBM assembly language and implemented

		West	Computer North (Dummy)	East	Computer South (Declarer)
Trick	1	**KD**	2D	5D	3D
	2	2S	**AS**	5S	3S
	3	**KH**	3H	4H	QH
	4	4S	**KS**	8S	6S
	5	5H	**JH**	TH	2H
	6	6H	**9H**	TS	7H
	7	9C	5C	3C	**QC**
	8	**AD**	2D	6D	JD
	9	TC	6C	JC	**AC**
	10	7S	7C	**KC**	4C
	11	9S	**8H**	8C	2C
	12	4d	**QD**	7D	JS
	13	9D	QS	8D	**AH**

Tricks N-S (computer): 9 Tricks E-W: 4

The tableau above shows the play just described, trick by trick.

on an IBM 370/135. Fidelity learned of the program last fall and asked Tim to adapt his program to Fidelity's bridge product. Tim came to the United States and spent six months with Fidelity enhancing his bidding program and integrating it into the Bridge Challenger.

Tim's bidding program caters to both the Acol style of bidding, popular in many European countries, and the American style of bidding. In either style, certain options may be selected for each position the computer is to play. These options include the weak opening one no-trump, five card majors in opening position, the Jacoby transfer and the Baron convention. The Blackwood, Gerber, and Stayman conventions are always employed by the bidding program. The bidding program takes about 10K of memory.

The playing program was developed by Thomas M. Malinsky of Fidelity. He worked on the program from early October of 1978 until April of 1979. The playing takes about 6K of memory, with the code for the declarer requiring approximately twice the space of that for the defenders' play.

In the bidding program, one of the last areas Scanlan considered was cue bidding of controls when exploring slam possibilities. This procedure is often employed by good players to show specific aces, kings, voids, and singletons. The general idea is that once a trump suit has been agreed upon by a partnership, subsequent bids of other suits are used to show these controls. The following deal is an example

NORTH

♠A10
♥Q10932
♦QJ73
♣A6

WEST	EAST
♠9875	♠KJ643
♥J876	♥4
♦95	♦86
♣1043	♣K9872

SOUTH

♠Q2
♥AK5
♦AK1042
♣QJ5

of very fine cue bidding by Tim's program in reaching a slam:

The bidding (with the computer program bidding all four hands) is shown below:

BIDDING DEALER: NORTH

N	E	S	W
1H	1S	3D	P
4D	P	4H	P
4S	P	5D	P
6C	P	6D	P
6H	P	P	P

North opens the bidding with 1 heart. This indicates at least five hearts, since the program is employing the 5-card-major option for opening bids. East overcalls 1 spade. South jump shifts to 3 diamonds showing 19 or more points. West passes and North supports diamonds, bidding 4 diamonds. East passes and South now shows his three card heart support by bidding 4 hearts.

With hearts now the agreed trump suit, North and South embark on a series of cue bids to show specific aces and kings while exploring small slam and grand slam possibilities. North's cue bid of 4 spades shows the ace of spades or a void. South's bid of 5 diamonds skips over 5 clubs, which would show the ace of clubs or a void, and indicates the ace of diamonds. North's next bid of 6 clubs shows the ace of clubs or a void. South's final bid of 6 diamond shows second round control in the suit, which in this case must be the king. North now has no furthr side suit aces, kings, voids,or singletons and therefore bids 6 hearts. South, knowing that both the king of spades and king of clubs are missing, settles for 6 hearts as the final contract and passes.

The contract of 6 hearts can be made easily be discarding either North's 10 of spades or 6 of clubs on South's fifth diamond. At the table, the best chance for an overtrick is to throw the 10 of spades on the diamond and finesse West for the king of clubs. However, with the cards as shown, the play fails whereas a squeeze on East will succeed. East selects a safe opening lead of a heart or a diamond against the contract of 6 hearts. North plays five rounds of hearts, cashing the ace of clubs, followed by four rounds of diamonds. With the lead now in the South hand, the following situation has been reached:

NORTH

♠A10
♥—
♦—
♣6

WEST	EAST
(Immaterial)	♠KJ
	♥—
	♦—
	♣K

SOUTH

♠Q
♥—
♦10
♣Q

The last diamond is now lead from the South hand and East is squeezed. Whatever he discards will permit N-S to win the rest of the tricks for an overtrick.

Some afterthoughts: Deals 32, 37, 39, 40 and 41 of George Duisman's program will be discussed next month. There will also be some additional comments on Tony Wasserman's bidding program.

Due to an error the deals shown in April were switched around. Deal #1 should be Deal #2 and vice versa. This would make the comments on the hands more logical. However, I have heard from many readers who told me they had figured out the problem themselves after floundering around a bit.

One other point on the Duisman program needs to be mentioned. The random generator that creates the hands is different in the Pet than it is in the TRS-80 or in the Apple. So, as a result, the deals will be different in all three computers and the play of the hand will also be different, as the Pet carries an 8 K memory program and the other two have 16K. So, for example, Deal #32 on the TRS-80 is not going to be the same as Deal #32 on the Pet.

Introduction to Personal Computers

Personal Computers: What They Are and How to Use Them, by Byron G. Wels; Trafalgar House Publishing, Inc., Englewood Cliffs, NJ 07632; 193 pp.; $12.95 hardback, $5.95 paperback.

As the title implies, this easy-to-read introduction to personal computers is written for beginners thinking about buying their first computer. "It is not necessary to know all the technology that went into building the hardware or the machinery of the computer. It is more important to know how it will work for you," according to Wels.

Formerly Electronics Editor for *Popular Mechanics* magazine, Wels attempts to present an overview of the topic and also provide specific tips for buyers. For example, his first chapter, "How to Buy a Computer", tells prospective owners to check the instruction manual. "Be certain that you are able to read and understand the manual before buying the computer," writes Wels. Other things to look for include limited warranties and options that can be added to the basic unit.

Two chapters are particularly valuable to beginners because they dispel the mystery of computer operations. In "What Makes the Computer Tick", Wels simply explains the computer's circuitry and use of the binary system. "Programming a Computer" effectively illustrates the logic of computer language. Using one language, BASIC, as a model, Wels teaches readers step-by-step how to write simple programs.

After explaining how computers compute, the author describes peripheral equipment — devices needed "to communicate effectively with a computer." These devices include keyboards, printers and cassette tapes (for memory storage).

The fifth chapter gives more tips on buying and owning a computer. For example, unlike purchasing directly from manufacturers, computer stores provide model comparison, salespeople to answer questions and demonstrations. Wels also discusses purchasing business computers. At the chapter's end is a list of 39 manufacturers and stores with their products.

"Maintaining the Personal Computer" describes how to preserve a computer's life and what repairs an owner can expect. Wels explains cleaning, spotting defective components and repairing simple problems.

"Computers are destined to enter our everyday existence in situations that might surprise many of us," according to Wels. In his last chapter, "The Future Is Here Today", he discusses the more common computer systems and computer applications such as a teaching aid, recipe file and vacation planner. Next he illustrates how computer technology has improved products from watches to microwave ovens.

Two more aspects of Wels' book helps beginners understand computers. He uses almost 50 photographs to familiarize readers with specific products. And a 26-page glossary of terms follows the last chapter.

Short divisions and large type make reading easy. However, a large number of typographical errors, while easily spotted, are distracting.

Nonetheless, as Wels intended, the book provides a stepping stone to understanding computers. "From here, you can go on to higher levels of reading, or be satisfied that you have a working knowledge of this burgeoning new technology," he writes.

— Reviewed by Joe Bobbey

Advances in Computer Chess 1, edited by M.R. B. Clarke, Edinburgh University Press, 22 George Square, Edinburgh, Scotland, ©1977; 118 pages, 3.50 Pounds net. (Note: This book is also available for $10 from Edinburgh University Press, c/o Biblio Distribution Center, 81 Adams Drive, Totowa, NJ, 07512.)

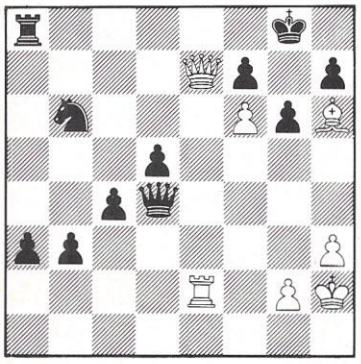
In March of 1975, in England, a symposium was held that was devoted entirely to a discussion of the latest advances in computer chess up to that time. That exchange of ideas took place at Balliol College, Oxford. A record of the proceedings was issued in the form of a book and was titled *Advances in Computer Chess 1*. Editor of the collection of papers is M.R. B. Clarke, lecturer in computer science at Queen Mary College, University of London.

Editor Clarke says that the "1" in the title indicates this is to be the first in a series of further such proceedings. Four years have passed since that first meeting and the second volume of the series has yet to make its appearance. This delay indicates that advances in computer chess (as well as advances in computer science) move along at a comparatively slow pace, compared to explosive developments in other fields of science. The reason for the paucity of information on computer chess was summed up recently by David Slate during the ACM conference in Washington, D.C.: "Anyone who's done any computer programming at all," stated Slate, "knows that it takes a long time to implement a relatively simple idea. Getting that simple idea to improve a chess program, for example, may take years to implement — years of work. Even ideas that seem elementary may take 10 or 20 years to implement." The papers in *Advances in Computer Chess 1* show how much work has already been put into this research and hint at the work that goes on continuously.

Seven papers were delivered during the symposium including a highly complex mathematical analysis by the Russian team of computer scientists that had written the former world chess program, KAISSA. Other participants were H. J. Berliner of Carnegie-Mellon; D. Michie, University of Edinburgh; R. H. Atkin, University of Essex; S. T. Tan, University of Edinburgh; J. A. Birmingham of AERE, Harwell, together with P. Kent, of Atlas Computer Laboratory; and M. R. B. Clarke, of Queen Mary College.

Titles of the seven papers delivered are: "Methods of Reduction for Exhaustive Search Problems", "A Problem Solving Chess Program", "King and Rook Against King", "Positional Play in Computer Chess", "Describing Pawn Structure", "Tree-searching and Tree Pruning", and "King and Pawn Versus King".

To anyone interested in the mathematical intricacies of this science, the Russian paper is an excellent source of information. It is a dense maze of complex formulae in computational and geometric relationships. It explains, in pure mathematical terms, the enormous search techniques intrinsically tied to chess analysis and offers new formulae to help reduce this search time in the computer. Only a few scholars will probably linger in this complex discussion which opens the symposium. Most readers will prefer to move ahead to the more readable chapters of computer chess. Berliner, for example, describes his 1974 problem- solving chess program (CAPS-II) which defines the functions of all pieces in a problem on the chessboard, then uses these definitions to develop solutions. His program, as an example, solves the following problem:



Black to Play and Avoid Quick Mate

It can be seen that after Black plays P-R7, White threatens mate in two by Q-Q8 ch then RxR mate. So the CAPS-II program backs up through its "causality facility" (explained in the book) and finds six defensive moves to prevent this mate. The six choices found are: Q-K4 check, or Q-K5, or Q-K6, or R-KB1, or N-Q2 or K-R1. After a little tree search the program decides that the optimum variation for both sides is 1....Q-K5, 2. RxQ, PxR. CAPS-II does not recognize that Black now has a winning position because all of White's threats have been met and there's no stopping Black from Queening a Pawn! But CAPS-II does find a defense very quickly, which is the objective of the program.

At this point, some intruder has deposited a handwritten comment in the book. It is an analysis which strongly differs from Berliner's conclusion. The identity of the scribbler is not known; perhaps it is the proofreader, perhaps a worker at the book bindery, perhaps the postmaster, perhaps someone at Edinburgh Press. In *Advances in Computer Chess 1* the stranger has written, in great agitation (one sees the quivers in the pen strokes): "Not so!! 1...Q-K5; 2. RxQ, PxR; 3. B-K3, P-R7 (or N7); 4. BxN, P Queens; 5. B-Q8, P-R4; 6. Q-K8 ch, K-R2; 7. QxPch, K-R3; 8. Q-N7ch, K-N4; 9. P-B7 dis ch, with drawing chances for White!"

Although a careful search reveals that the mysterious hand has left no other marks elsewhere, the remaining papers of the symposium are as informative as Berliner's discourse. It is a book worth reading for both the chess analyst and the student of computer science. Titles of the papers indicate the many fields that are explored and bring the reader practically to the brink of current progress in computer chess. The book abounds in documented games of computers versus humans plus analysis of computers' thinking process while playing. Such a game is shown in Atkin's paper, "Positional Play in Chess by Computer", where a 1904 game between Lasker and Napier is dissected and analyzed by a computer. A mathematical relation of a proposed move is shown and an explanation given of what the evaluation meant to the computer.

After reading the book, one comes to the conclusion that computer chess is a probe into the methods of complex human-problem solving, whether it be determining the next best move in a chess game or simulating a thermonuclear explosion in the machine's printout. Readers of volume 1 are sure to look forward to the eventual appearance of volume 2 and all the new advances in "thinking" that will have taken place through the sensibilities of the computer in the passing years.

—Reviewed by Harry Shershow

Robotics: Grivet Series, 1979, by Gallaher Research Inc.; P.O. Box 10767, Winston-Salem, NC 27108; 108pp.; over 80 illustrations.

You have just finished playing a three-hour game of chess against your computer when you realize something is wrong. It's your eyes. Three hours of staring at a CRT have burned out your retinas. Of course, you could use a chessboard, but moving the computer's pieces somehow lacks — well — class. What's the solution/Build an arm for you robot, obviously.

Now available from Gallaher Research Inc. is a catalogue/book entitled, simply, *Robotics*.

Consisting of over 100 loose-leaf pages in a three-ring binder, the catalogue lists everything from motors to bearings and from transformers to solid state cameras; in effect, everything needed to build your own small robot system. Also included is a ten-page section on nomenclature, which gives this definition for a robot: "Robot is an adaptable, cost-effective automaton designed for material handling, inspection and assembly tasks with general applicability to a wide range of batch-produced discrete-parts products. A robot must always replace human labor and be trainable." I have always preferred the concept of robots augmenting, rather than replacing, human labor. A couple of more pages go on to explain the philosophy behind GRI.

The catalogue section contains mostly free-hand sketches while the textual sections are printed using a dot-matrix printer. All this adds up to a rather unpleasant reading experience.

While this book is far from the ultimate treatise on robotics, it is a good start. Using this catalogue, an experimenter can make a large dent towards designing a robot system. Unfortunately, *Robotics* discusses nothing on the control electronics and software, so for that part you're on your own.

GRI offers the discrete components, plans for complete systems and kits, containing hardware to complete one of the systems.

The last page is a catalogue registration form, which, when completed and returned to GRI, guarantees the owner all the amendments to the catalogue.

If you are interested in robotics research, or just a new hobby, then you should add this book to your library.

—Reviewed by Mitchell Weiss

WHAT'S COMING UP

SYSTEMS

Improvements to the System 88 Business Microcomputer

PolyMorphic Systems announced two improvements in its System 88 computer for business and professional use. An improved keyboard is shipped with new computer systems, while an expanded BASIC is available for both new systems and those already in use.

The new keyboard has an added numerical pad which matches standard adding machine keyboards, with an enter key, minus key and clear key. The number 5 also has the standard homing dot.

In addition to more file handling capabilities, the Applications Development BASIC has other new features. READ and WRITE allow arbitrary string and numeric data storage in fixed length records. CHAIN permits loading programs without affecting variable storage and allows "infinite" program length, according to the company. DRAW creates a graphic line on the video display from the current cursor position to any other position on the screen. These and other features are described in the included manual.

The System 88 includes a keyboard, CPU board, 9" monitor, two-drive disk unit, 32K bytes of memory, printer interface, BASIC, word processing and maintenance testing. Suggested retail price for the complete system, including new keyboard and expanded BASIC, is $4850.

For more information contact PolyMorphic Systems, 460 Ward Dr., Santa Barbara, CA 93111; (805) 967-0468. *Circle No. 102*

Systems Teach Students About Computers

Technico, Inc., announced its Educator 900 series of computer systems, designed to introduce students to the microcomputer world, according to the company. The series, for high schools and universities with students in computer science, mathematics and business, is a teaching aid for understanding computer language and microcomputer applications. It can also teach business package development.

Three different systems in the series range in price from $895 to $5895.

The Educator 920 system consists of the 9900 CPU module, 8K bytes of user RAM, 16K or 32K bytes of EPROM, a black and white video module with several special I/O functions such as audio cassette interface, microphone input, 8 ohm speaker output, solid state AC relay, buffered CPU edge card expansion port, 16 line by 64 character video output, RF modulator mounting area for twin lead TV interface and 47 to 63 Hz operation.

Educator 930 has all 920 features plus a 32K memory

module and Dual SA800 floppy disk with controller. It is supplied with the Technico EAL level 1 character editor, assembler, and relocatable link loader and Technico Super BASIC on floppy disk. The Technico ANSI FORTRAN IV is also an option for the 930 system.

The Educator 900 ASCII keyboard with LED display, 8 ohm speaker and microphone input jack, and CPU interface cable is also standard with the 920 and 930 systems.

All Educator 900 systems come with the 9900 CPU Self-Teaching Instruction Guide along with a 300-page user's manual with system schematics. The software, firmware and documentation is packaged so the student can learn Assembly Language programming through higher level language software development using BASIC and FORTRAN IV. Each system also has one RS-232-C/20 ma I/O port so a hardcopy printer or CRT device can be interfaced.

For more information contact Technico, Inc., 9051 Red Branch Rd., Columbia, MD 21045; or call their Computer Products Marketing division at (301) 596-4100. *Circle No. 103*

Apple Education System

In an agreement with Apple Computer, Inc., Bell & Howell offers a specially-designed Apple II microcomputer system for education applications. Another application for the system will be industrial training.

The system includes the Apple II, programmed software, cassette tape recorders and floppy disk systems for memory storage, printers, interfaces and other peripheral devices. Apple II features BASIC and assembly computer languages, color video graphics, and 12K or more memory capacity. Price for the basic unit is about $1200, depending on options.

Classroom use of the computer can speed teaching methods, improve student performance and provide familiarity with computer technology, Bell & Howell said.

For more information contact Bell & Howell, Audio-Visual Products Div., 7100 N. McCormick Rd., Chicago, IL 60645; (312) 262-1600. *Circle No. 104*

PERIPHERALS

TRS-80 Printer Interface

American Micro Products announced a parallel line printer interface for the TRS-80 which eliminates the need for the Expansion Interface when driving such printers as Centronics (PI, 779 and 703), Telpar and Axium.

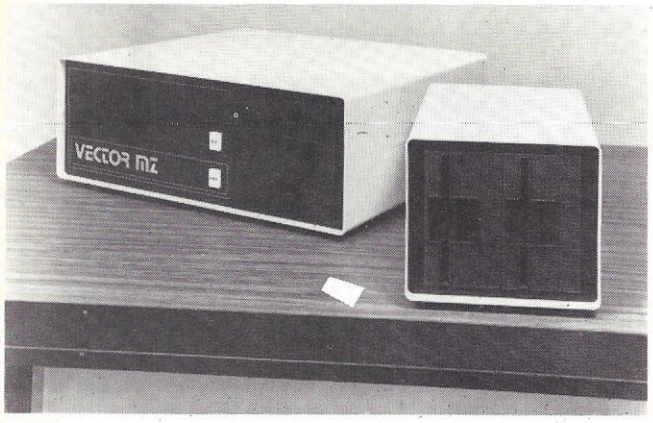
The TRS-80 Print Module measures 4-1/2" × 2-1/2" × 1/2" and plugs directly into the computer's keyboard. All line print commands in Level II BASIC are compatible. Because the Module draws power from the printer, the TRS-80 remains unaffected by the interface, according to the company.

Print Module sells for $99.95. For more information contact Bill McNeil, American Micro Products, 6550 Tarnef, M/S 11, Houston, TX 77074; (713) 777-2759.

Circle No. 105

Doubles Disk Storage Module

A 630,000 character dual floppy disk module from Vector Graphic called Micro-Stor, expands Vector Graphic MZ and Memorite II systems from two disk drives to four, allowing implementation of business and scientific software requiring this increased storage capacity.



Micro-Stor features two Micropolis MOD II quad density disk drives in an attractive chassis, using standard 5.25-inch, 16-sectored diskettes. The module requires little effort to attach; simply plug into the existing disk controller board, and go, the company said. The operating systems presently in use on Vector Graphic hardware were prepared in advance to make use of four drives.

Tested and assembled, the Micro-Stor retails for $1395 and is available from authorized Vector Graphic dealers. For more information contact Vector Graphic, Inc., 31364 Via Colinas, Westlake Village, CA 91361; (213) 991-2302.

Circle No. 106

Data Communications System for Apple II

A complete data communications system for the Apple II personal computer Micromodem II can transmit data between an Apple II and another Apple II, a terminal, another microcomputer, a minicomputer or even a large time-sharing computer anywhere in North America over regular telephone lines.

The system includes serial I/O, 1K byte of firmware, a modem and an FCC registered interface.

Micromodem II converts digital data into analog signals for transmission over regular voice telephone lines. Because it is Bell System 103 compatible, it can communicate with the most commonly used modems in North America. The Micromodem II can operate at either 110 or 300 baud, equivalent to 10 or 30 characters per second. It is equipped with an FCC registered Microcoupler data access arrangement which feeds the signal into the telephone line through a modular connector provided by the local telephone company. Since the Micromodem II directly connects with the telephone line, it can automatically answer the phone or originate a call by dialing numbers typed on the Apple II keyboard or generated in a program.

The unit comes with all necessary programs in read only memory to operate in any of three modes: terminal mode, where the Apple II is used as a terminal; remote console, which allows another terminal to call the Apple; or program control, where BASIC language programs are easily completed after review of examples in the owner's manual.

Micromodem is available from most Apple II dealers. For more information contact D. C. Hayes Associates, Inc., 16 Perimeter Park Drive, P.O. Box 9884, Atlanta, GA 30319; (404) 455-7663. *Circle No. 121*

Low-Cost Printer for TRS-80

Radio Shack has introduced an inexpensive printer that produces low-cost hard-copy output on 2-3/8″ wide aluminum coated paper.

The new Radio Shack TRS-80 Quick Printer II prints both upper and lower case characters, as well as double-size characters and double-spaced characters to allow for special effects such as titling pages or printing headings.

Automatic "wrap-around" prevents data loss due overflow when the text exceeds the maximum line length, according to Radio Shack. The printer is software selectable for 16 or 32 characters per line, and produces 120 lines per minute, 64 characters per second.

Character set is a modified subset of ASCII, 96 characters with upper and lower case, 5 × 7 dot matrix, 6 lines per inch vertical spacing. It can produce all 32 ASCII control codes in addition to codes for the printed characters.

Although designed for use with Level II TRS-80 systems, the printer can also be used with a variety of other computers. Quick Printer II features three interfaces: TRS-80, RS-232C and 8-bit parallel. It can be connected directly to the TRS-80 CPU, or, with optional cable, to the TRS-80 expansion interface. It operates on 120 VAC. Size is 3-5/16 × 6-3/4 × 9-1/4″.

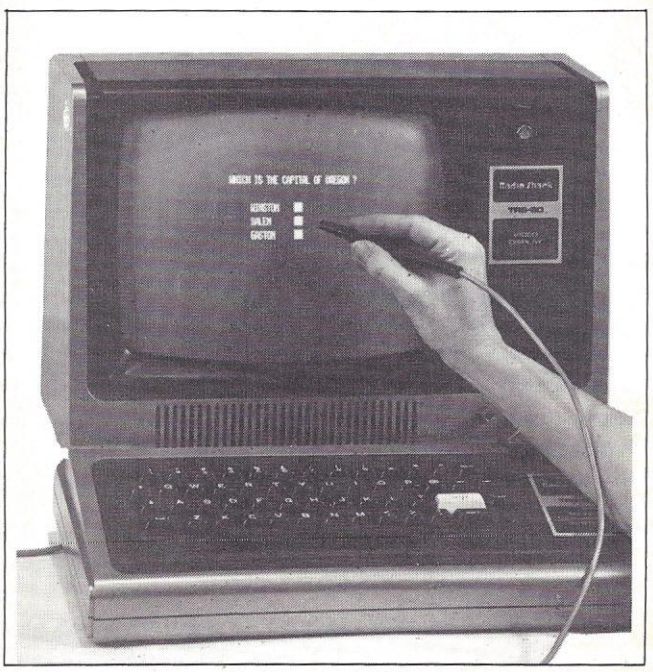
The printer, available from Radio Shack stores and computer centers, is priced at $219.

For more information contact Radio Shack, 1300 One Tandy Center, Fort Worth, TX 76102; (817) 390-3272. *Circle No. 122*

Light Pen for TRS-80

A self-contained light pen from 3G plugs directly into the TRS-80 bus connector, allowing you to bypass the keyboard and interact directly with the information displayed on the CRT screen.

You can select from a menu displayed on the screen using the light pen. This interaction makes it easy for the non-computer oriented person to use an applications program. The pen also allows a child to interact directly with the display on the screen. The child does not need to know how to type; therefore a program in conjunction with the light pen can be used as a teaching aid or a game for young children.



The light pen comes completely assembled and ready to plug into the TRS-80. A sample program and programming instructions are included with the pen, which is sold mail

order with a thirty day/unconditional money back guarantee. The entire package sells for $34.95 (plus $1.50 for postage and handling within the United States; $6 for foreign orders).

For more information contact 3G Company, Inc., Rt. 3, Box 28a, Gaston, OR 97119; (503) 662-4492. *Circle No. 123*

SOFTWARE

Text Editor for TRS-80 and Sphere

Programma International, Inc. has available their text editor, called PIE (Programma Improved Editor). The 2-dimensional, cursor-based editor is designed to operate on the TRS-80 Level II (16K) and Sphere 6800 systems. The program generates cassette tapes compatible with the TRS-80 Editor/Assembler.

Over 25 commands permit cursor location anywhere on the screen and movement forward or backward a full page. Also, you can search for a string, append, insert, delete, backspace, set horizontal tabs and page scroll, said the company. Commands are simple to implement and consist of a single character depressed simultaneously with the shift key. Any command may be preceded by a numeric or string argument.

PIE, available soon for the PET and Apple II, is sold on cassette and diskette for the TRS-80 and Sphere, complete with operating instructions. The cassette version is priced at $19.95, and the diskette version at $24.95.

For more information contact Programma International, Inc., 3400 Wilshire Blvd., Los Angeles, CA 90010; (213) 384-0579. *Circle No. 124*

Data Storage and Tape Copying Programs

Mumford Micro Systems offers three programs for Level II TRS-80 microcomputers.

Clone allows loading any tape written for Level II and duplicating the tape directly from the computer. With the program, users can copy System tapes and data lists, plus modify or relocate System tapes. Clone's price is $14.95 plus $0.50 for shipping.

Data List, a two-string data file for information lists, allows string searches by any sub-string, alphabetizing hardcopy printing of selected data and more rapid tape storage. Data List's price is $16.95 plus $0.50 for shipping.

Mailing List is a five-string version of Data List which allows searching by any sub-string, alphabetizing by either of two categories, hardcopy printing and quicker tape storage. About 100 names are supported 15K. Price is $19.95.

When ordering, specify memory size. California residents

add 6 percent tax. For more information contact Mumford Micro Systems, Box 435-D, Summerland, CA 93067; (805) 969-4557. *Circle No. 120*

Text Editor/Word Processing System

A text editor/word processing system, Maryelln, is available for the North Star disk. The system contains features of the North Star BASIC editor, string handling features of larger editors and word processing capability.

There are 29 commands including AUTO, DELETE, RENUMBER, SCRATCH, LOAD, SAVE, NULL, EDIT, LIST, NSAVE, APPEND and QUIT. String handling commands include FIND, CHANGE, CHANGE ALL, MOVE and COPY. These commands allow you to find and change characters or phrases, or move and copy entire lines of text. Word processing commands include OPEN, TITLE, LINE, SPACE, UNIT, PAGE, JUSTIFY, REPEAT and PRINT. Line fill, justification to the right margin, centering of titles, automatic insert (for use in form letters), titles, page numbering and forms control are done under the PRINT command. Other commands include FREE, SCREEN and CONFIGURE. Multiple printers can be used. Different page sizes can be handled. Twenty-six messages give specific information on errors and system action. Maryelln will also edit source programs for some assemblers.

Maryelln, written in 8080 assembler language, is loaded at 2A00H. The data area is from 4500H to the top of memory so it will run in as little as 16K. A special version for double-density disk users loads at 2D00H. The only system requirement is one disk drive with the North Star DDS.

The system comes complete with documentation for $38 plus $1 postage and handling plus California tax. For more information contact Surf Computer Services, PO Box 3218-B, North Hollywood, CA 91606. *Circle No. 113*

FORTRAN String Routine Library

Key Bits Inc. has announced The String Bit, a collection of FORTRAN character string handling routines and a library of custom routines that can be expanded by the user. These two libraries are complemented by an interactive demonstration program to exercise the routines and demonstrate each routine's capabilities and limitations, said the company.

The String Bit is suited for FORTRAN applications requiring command identification, parsing and interpretation, editing, character string file management, inquiry systems and report preparation, said Key Bits.

The String Bit includes source code for all libraries and programs, in FORTRAN, and is distributed on either a 5" or 8" CP/M compatible soft-sectored floppy disk for $45. A reference manual designed to aid first-time users is included.

For more information contact Key Bits, Inc., PO Box 592293, Miami, FL 33159. *Circle No. 114*

Diagnostic Software for TRS-80

Diagnostic software for the TRS-80, detecting malfunctions in hardware circuitry which would result in faulty data output, is available from VR Data. The new software is written in separate programs to test RAM, ROM, CPU and I/O circuitry for errors.

The programs cost $34.95 each on cassette or diskette. For more information contact VR Data, 777 Henderson Boulevard, Folcroft Industrial Park, Folcroft, PA 19032. *Circle No. 115*

8K BASIC in Eprom

The Personal Computer Place offers the 2.3 version of SWTP 8K BASIC relocated to C000 and put on four 2716 EPROMS.

For $10, the company will program four EPROMS (2716) which you supply, as well as send you the SWTP manual and tape. Contact The Personal Computer Place, 1840 W. Southern, Mesa, AZ 85202. *Circle No. 116*

Data Manager Software

Mycroftware Systems has announced a data manager for users of the Flex operating system. Lookup works with data records and can add, delete, inquire, create, print, list and purge records. Applications range from a simple name and address list to financial or inventory record applications.

Data records may be variable length with a variable number of fields. Data files may also be edited for massive or complex changes to records. Data is accessible from BASIC for mathematical manipulations or custom reporting.

Lookup comes complete with a 5-inch minidisk, reference manual, sample data file, source listing and source program on disk. Also included is an index of all 6800 articles from major hobby magazines for inquiry from disk.

Lookup, written in fast assembly language and run in a minimum memory system, is available for $49.95 from Mycroftware Systems, P.O. Box 1138, St. Charles, MO 63301. *Circle No. 117*

PET Software

Four low-cost PET programs intended for business applications are available from Home Computer Centre.

Entry is a general purpose data entry program with user definable entry format. The program may be used for mail list, daily journal, general ledger and record keeping. Entry

works with IEEE devices.

Process, a general purpose data process program, is designed for limited data processing power on the PET. Basic operations include Sort, Edit, Delete, Insert and Macro. The program is useful for merging large amounts of data from different input sources.

The DCE Text Editor and Formator is a word processor package. Full use of the screen editor includes all cursor movements with repeatable cursor. Data is exactly what you see on the screen; pages may be scrolled up and down. The programs are written in machine language with 4K bytes free for user text data.

An Inventory program generates inventory report and low inventory report. Included are item number, description, quantity on hand, reorder limit and prices. Up to 60 items can be handled on the 8K PET. Data may be inserted, deleted, changed or put on memory instantly.

Each program, priced at $24.95, comes with complete documentation. For more information contact Home Computer Centre, 6101 Yonge Street, Willowdale, Ontario, Canada, M2M 3W2; (416) 222-1165. *Circle No. 118*

tiny-c Interpreter

Available from tiny c associates is the tiny-c interpreter and Program Preparation System in several new formats: TRS-80 cassette; CP/M 8'' soft-sectored and Micropolis 5'' dual or quad density diskette; and North Star DOS 5'' single density diskette.

A structured programming language, tiny c is designed for problem-solving applications.

The TRS-80 cassette is recorded in Level II System format, includes line printer and graphics support, and reads and writes EDTASM compatible files. At least 16K bytes of random access memory is recommended for its effective use, according to the company. The load-and-go TRS-80 cassette costs $30.

The CP/M and North Star installations are fully interfaced to their respective disk operating systems. The CP/M diskette also contains the source code of the tiny-c interpreter. The North Star version loads at 2A00. Both the CP/M and North Star diskettes cost $35 each.

Documentation for the tiny-c language, the tiny-c Program Preparation System and the operation of the tiny-c interpreter is contained in the *tiny-c Owner's Manual* at $40.

For more information contact tiny-c associates, P.O. Box 269, Holmdel, NJ 07733; (201) 671-2296. *Circle No. 137*

Graphics Software for Sorcerer

Public Computing, Inc., offers six casette programs using the Exidy Sorcerer's graphics capabilities.

Programs available include: Blackjack; Biorhythms; Sub/Ship Chase Game; Compucards, a personality test and fortune telling program; Atom, an inductive logic program in which rays are sent into a black box and are then deflected, reflected and/or absorbed, thereby allowing the player to determine the location of the atoms within the black box; and Map, a three mode program which displays a map of the United States with each state outlined, plots individual states on command and offers a CAI State Capital quiz.

These programs are available at $9.95 each or $19.95 for a set of any three. For further information contact Public Computing, Inc., #10 North Earl Avenue, Lafayette, IN 47904; (317) 447-9439. *Circle No. 107*

Modem Utility Program for North Star Disk

Telestar is an 8080 assembly language package for transferring named disk files through the phone, via a modem, between two 8080 or Z-80 computers utilizing the North Star disk system. The package also communicates with any remote timesharing system, saves all exchanged ASCII data to disk and retrieves that data from disk for later display or printout, said the manufacturer. The program allows a remote user to access and share the inputs and outputs of any program that uses the North Star DOS for I/O. The program was written for a North Star Horizon computer but has a self-patch customizing routine for other types of I/O.

A two serial port system plus acoustic coupler modem is required and at least one party must be able to "answer" to use the file transfer mode.

Documentation includes customizing and operating instructions, a list of hobby timesharing systems that can be called using the program along with the passwords, and a sample data file containing text received from a remote system. The package is available on disk for $30.

For further information contact Leonard E. Garcia, 3517 Herschel Ave., Dallas, TX 75219. *Circle No. 108*

Apple II Business Software

Interactive Tiny Business Inventory Management System, Accounts Receivable and Accounts Payable for the APPLE II are available from Custom Computing Systems. Each software package requries a minimum system configuration of 48K and one disk drive and an optimum configuration of two disk drives and floating point firmware. The Inventory Management System ($100) supports 820 separate inventory items and 100 suppliers. Hueristic techniques monitor reorder levels and quantities to assist the user in evaluating stock sales. The Accounts Payable ($75) and Accounts Receivable ($75) programs handle 150 accounts each.

Each software package offers password protection to allow the user security on sensitive portions. The speed is reasonable and a careful human factors approach minimizes data entry errors and software crashes, the company said.

For more information contact Custom Computing Systems, Inc., 204 Second Avenue North, Saskatoon, Saskatchewan S7K 2B5, Canada; (306) 242-7808. *Circle No. 109*

BASIC ETC Language Interpeter for 8080/Z-80 Systems

Percom Data Company has added BASIC ETC., a BASIC language interpreter for 8080/Z-80 systems using cassette storage, to their catalog of software products.

BASIC ETC, developed by the co-authors of the original Tiny BASIC, is suitable for business, scientific and games programming, said Percom.

The program requires 9.5K bytes of RAM. Features include:

- Integer, real and string variables.
- Integer constants ranging from −32,767 to +32,767 (0 to 65,536 as array subscripts or memory references).
- Real constants from $n \times 10^{-62}$ to $n \times 10^{62}$, with the number of significant digits selectable from 6 to 72. (Default = 6.)
- 11 string commands and functions.
- n-dimensional arrays.
- Program line numbers from 1 to 65,567.
- Direct memory and I/O addressing.
- Error detection; 27 error messages.
- Character and line erasure during input.

In addition to the ordinary BASIC commands and statements, BASIC ETC includes PRMT for user-selection of the prompt character; an optional LET command for assignment statements; READ, which may point to data derived from evaluation of an expression; SD, which sets the number of significant digits for floating-point values; and a GOTO command that may be either unconditional or computed from input data.

BASIC ETC includes EDIT, FN(n) and 18 other functions. Transcendental functions return values accurate to 0.001%.

The interpreter is supplied on a 1200-baud cassette compatible with Percom's S-100 bus interface card (the CI-812), along with a 42-page user's manual, for $35.

Orders may be placed by dialing Percom's toll-free ordering number: 1-800-527-1592. For more information contact Percom Data Company, 211 N. Kirby, Garland, TX 75042; (214) 272-3421. *Circle No. 110*

CAI for the Apple II

Computer Aided Instruction for home and school is available with APPILOT language from the Muse Company. An Apple II version of a standard CAI language, APPILOT creates multimedia learning experiences for students by using text, graphics and sound.

Included features are color graphics commands, a musical mini-language and disk commands for lesson segmentation, which gives a lesson size up to 90K. APPILOT also links to the Apple's integer BASIC to allow calculation capacities. APPILOT is available on disk or tape.

For $17.95, Super-Load tapes of the software are for Apple owners who want to run pre-written lessons on their home computer. Users can execute lessons on a 16K Apple. The tape includes the APPILOT interpreter and a demonstration lesson about the language. Users can also receive a documentation manual for running APPILOT and/or for linking it with the Muse APPEN-I Text Editor for creating and editing lessons.

For educational and other institutions, APPILOT comes on an Edu-Disk for the 32K Apple. Users can develop lessons, store them on disk and run them with the interpreter. It includes interactive instruction lessons to teach use of the system. The Edu-Disk with manual costs $49.95.

For more information contact the Muse Company, 7112 Darlington Dr., Baltimore, MD 21234; (301) 661-8531. *Circle No. 111*

Software for Sol

A new software package, MailMaster, simplifies processing and management of mail lists for use with Processor Technology's Sol computer.

Using a disk as the memory medium, the program provides storage of up to 5090 names, addresses and other data in a single list. Each entry can consist of up to 1000 characters distributed among a maximum of 99 lines.

Entries may be added, deleted or updated rapidly without sorting, said the company. Mailmaster prints mailing labels automatically for all names on the list or a selected group. Inputs for four automatic addressing machines used in bulk mailings can be prepared. Personalized form letters can be printed automatically when the program is used with Processor Technology's WordWizard Electronic Typing System.

The easy-to-learn MailMaster program operates with Sol Systems III or IV. Sol System III includes a dual drive Helios II disk system, Sol computer with 64K bytes of memory and a video monitor. Sol System IV is similar with a quad drive Helios II for mailing lists up to 5000 names. Several printer options are available.

Suggested price of the MailMaster software package including disk and documentation is $395. MailMaster is available through Processor Technology dealers. For more information contact Processor Technology, Inc., 7100 Johnson Drive, Pleasanton, CA 94566; (800) 227-1241, toll-free; in California, (800) 972-5951. *Circle No. 112*

Educational Software

The Software Factory offers Level II TRS-80 and PET software for educators using computer-assisted instruction in the classroom. Their initial guided drill, practice and instruction programs include:

- Introduction to Microcomputers, 6 programs, 3 tapes plus teacher's guide, grades 1-8, at $49.95.
- Basic Math Skill Games, 12 programs, 6 tapes plus teacher's guide, grades 1-8, at $89.95.
- Word Problems, 6 programs, 3 tapes plus teacher's guide, primary grades, at $54.95
- Spelling I and II, 12 programs, 6 tapes plus teacher's guide, primary grades, at $54.95.

These completely supported programs use the microcomputer's graphic capabilities and contain safeguards to minimize accidental program loss, said the company. All programs are loaded on individual cassette tapes and stored with support materials in a snap-in/snap-out, three-ring notebook. Future software packages include: Math Regrouping, Word Attack Skills and Metrics.

For more information contact The Software Factory, 515 Park Street, Anoka, MN 55303. *Circle No. 125*

Disk Text Editor for Apple II

A DOS Text Editor for the Apple II microcomputer, Edit was designed to facilitate changes to disk files, but input and output via cassette is also supported. The text editor includes 25 commands and will edit fixed or variable length disk files. System commands allow the user to Delete, Insert, Change, Display, Add and Print records. String commands facilitate searching and changing part of a record or the entire file. User defined tabs, file concentration, range and other commands are also included.

Written in Applesoft II extended BASIC, Edit requires 16K of memory with an Applesoft ROM or cassette only version; otherwise a minimum of 24K is suggested.

Edit comes on cassette or Apple II diskette, complete with user manual. Price is $16.95 (add $4 if on diskette and state if Applesoft ROM). Contact Services Unique, Inc., 2441 Rolling View Dr., Dayton, OH 45431. *Circle No. 126*

TRS-80 Software Service

People's Software, a nonprofit TRS-80 service organization, offers public-domain tapes containing as many as 77 programs for $7.50.

Included on Tape 1 are: mortgage calculation payments; Dow-Jones Industrial forecast; cash flow; inventory and change; journal ledger; loan amortization; bio-rhythm; payroll; diet; speed reading; and games.

Tape 2 includes: investment; future value regular deposits; regular withdrawals; Depreciation rate; mortgage amortization; polygon area; triangle parts; trig polynomial; simultaneous equations; check writer; recipe cost; day of week; and alphabetize.

For more information contact Computer Information Exchange, Box 158, San Luis Rey, CA 92068; (714) 757-4849. *Circle No. 127*

TRS-80 Telephone Dialer

Software Exchange announced its Z80 Telephone Dialer Program which allows the TRS-80 Level I computer to dial the telephone. The program can aid the handicapped or assist your baby sitter, according to the company. For example, in case of an emergency, the sitter can type "P" to dial the police or "F" for the fire department.

No internal connections are made to the computer. The program loads from cassette through BASIC, and uses a $4 interface built from Radio Shack parts.

Twenty phone numbers, accessed with the letters A through T, may be dialed. Both dial and pushbutton phones may be used.

The program is priced at $7.95, including the program on cassette tape and complete instructions, with interface circuit diagram and parts list. For more information contact Software Exchange, 2681 Peterboro, W. Bloomfield, MI 48033. *Circle No. 128*

Word Processing Software

Interactive Microware, Inc, has added the Pro-type Word Processor to its library of software packages. The software features text editing and processing combined in a single, compact program requiring 8K of memory. This arrangement permits interactive feedback of the results of editing, without the delay required to load a separate editor, said the company. Pro-Type is completely compatible with any kind of input terminal (Selectric; Diablo; memory mapped video; or non-memory mapped video CRT) and any kind of mass storage device (North Star disk or Meca tape recommended), according to Interactive Microwave.

Features include: tabs, underlining; dynamic change of margin width and line spacing during printing; double test buffers; right hand justification; stop and start during print cycle and paging.

With Pro-Type, most people can learn to type a business letter, edit it and print out perfect copies, in about an hour, said the company.

Pro-Type is available on North Star Disk or Meca Tape for $75, including a 72 page manual written for beginners. The manual is available separately for $250. For more information contact Interactive Microware,Inc. P. O. Box 771, State College, PA 16810; (814) 238-8294. *Circle No. 129*

TRS-80 Disk Drives and Software

Percom Data Company has expanded its line of "add-on" mini-disk drives for the TRS-80 to include both 40- and 77-track drives. Software is available to update Radio Shack's TRSDOS for use with the new drives.

One-, two- and three-drive systems can be supplied with either 40-track TFD-100 drives or 77-track TFD-200 drives. According to the company, the advantage of 40-track drives is that both sides of the mini-disks may be used for data storage. The TFD-100 units increase storage capacity to almost 205K bytes. A 77-track TFD-20 stores up to 197K bytes, and a three-drive system provides 591K bytes of on-line storage. The 77-track mini-disks are single-sided.

With each disk system sold, Percom supplies a Patch Pak #1 mini-disk which includes programs to patch TRSDOS, the TRS-80 disk operating system, for 40- and 77-track operation.

Two disk drives are required to apply Patch Pak #1. The TRSDOS (version 2.1) system disk is inserted in one drive and the Patch Pak #1 mini-disk is inserted in the other drive. The patches are applied to the system disk "on the fly".

Each TFD-100 and TFD-200 unit includes the drive itself, the drive power supply, Patch Pak #1 and an enclosure finished in TRS-80 silver enamel.

Interfacing of disk drives to the TRS-80 is accomplished with the TRS-80 expansion interface, which includes controller electronics and a four-drive cable.

Prices for the TFD-100 40-track drives are: 1-drive, $399; 2-drive, $795; 3-drive, $1195. Prices for the TFD-200 77-track drives are: 1-drive, $675; 2-drive, $1350; 3-drive, $2025.

The Patch Pak #1 mini-disk and application instructions are available separately for $19.95.

Orders may be placed by dialing Percom's toll-free number: 1-800-527-1592. For more information contact Percom Data Company, 211 N. Kirby, Garland, TX 75042.
Circle No. 130

TRS-80 Interactive Data Manager

IDM-III, the Interactive Data Manager from Micro Architect, provides a general purpose, interactive, simple but powerful solution to data base management, said the company. Ease of use by non-technical personnel has been the primary design consideration.

The software allows many applications to be computerized without any programming. The basic components of IDM-III are data base initialization, data base manupulation, report-formatter and report-generator.

Data initialization sub-system lets you specify the name, type, size of a field, the number of fields, the access method and maximum of records on-line. The data manipulation sub-system lets you add, display, print, delete or update a record.

Report-writer sub-system lets you specify the format of a report on-line. The user specifies the page heading and selects fields and filter criteria. Multiple sort-keys can be used. Field calculations include totals, averages, multiple, divide.

Report-generator enables the user to produce standard reports or reports previously specified by the user. Up to 10 reports can be specified on-line and saved in the disk. All reports have title, date and automatic page numbering.

Sequential and random accesses are both supported. You can randomly access a record by specifying a key or a record number. Features include hashing, blocking and buffering techniques.

Requirements are a TRS-80 DOS system and 32K memory. Price is $49. For more information contact Micro Architect, 96 Dothan St., Arlington, MA 02174.
Circle No. 131

Record-Keeping and Mail List Program

The Peripheral People have announced a new data base record keeping and mail list program for the TRS-80. Mailroom Plus is useful in applications requiring the management of records, including clubs, churches, bulletin mailings, patient checkup reminders, plus business applications.

All data is stored sequentially as a single string, then manipulated and sorted in memory. For display or printout, the string is disassembled to recover the original data inputs. This technique provides all the features of a random file. Record size can be any length from one to 255 characters and there is no need to specify field dimensions.

Mailroom Plus sorts 500 records by category number, ZIP code or last name in less then 45 minutes, said the company. A small file, with 50 names or so, sorts in less than 30 seconds. A standard TRS-80 diskette (with DOS) will hold approximately 2000 records.

A feature of Mailroom Plus is its ability to selectively search and display or print records. The print option will output either in tabular form or as mailing labels. Any part of the record can be used as a search code. Thus, it's possible to display or print specific states or ZIP codes, customer names, cities or category codes. After a zip code sort, all duplicates are displayed for operator deletion. Large files can be selectively separated and saved as smaller files by state or any portion of the ZIP code. Small files can be merged to create one large file.

In business applications, the category code can be used to maintain records of purchases, back orders, customer systems or any other code established by the user. The program also includes a category sort code which can be an employee, member or social security number or any alphanumeric code devised by the user. The BASIC language is used throughout to permit program modification, if desired. For example, a module (supplied) can be merged to print labels four across rather than the single labels supplied by Radio Shack.

Mailroom Plus requires a minimum of 32K memory and one or more disk drives. The program is supplied, along with documentation, on diskette for $49.95 postage paid. For more information contact The Peripheral People, Box 524, Mercer Island, WA 98040. *Circle No. 132*

COMPLEMENTS

Disk Storage Units

Alpha Supply Company introduced disk media housing: the Flexi-Matic for standard 8" diskettes and the Mini-Matic for 5¼" mini-diskettes.

Each media storage outfit consists of a scratch resistant steel tray with carrying handles, supporting plates to hold the media in an upright position, one set of indexes with insertable tabs and a

dust cover. Additional support plates, index sets and a locking steel hood are also available.

For standard diskettes, the Flexi-Matic FM-1 holds 110 diskettes and the FM-2 holds 50 diskettes. The Mini-Matic stores up to 50 mini-diskettes. All three trays may be stored in a standard letter size file cabinet drawer.

Flexi-Matic outfits are priced at $54.75 for the FM-1 and $37 for the FM-2. The Mini-Matic is $28.50. For more information contact Alpha Supply Company, 9625 Mason Ave., Unit 8, Chatsworth, CA 91311; (213) 882-9818. *Circle No. 133*

TRS-80 Cassette Data Enhancer

Microsette Co. introduced the Data Enhancer(Model DE-80) for the Radio Shack TRS-80 Level I or Level II. The unit is a black box that goes between the cassette deck and the TRS-80 to clean up and reconstitute poor quality cassette signals so they will load reliably with a volume setting of 4 to 10 on the recorder. The Data Enhancer eliminates 99% of all cassette loading problems, said the company. Tapes that are partially erased, cannot be read reliably.

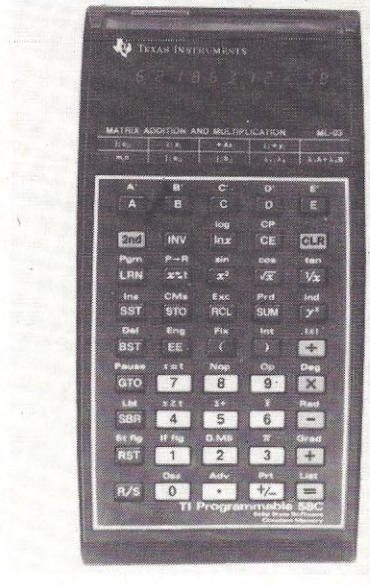
The Data Enhance has a switch to disable the enhancement mode without plugging and unplugging connectors. Also, an LED lamp glows when data is detected, helping to locate gaps between programs when more than one program is recorded on the cassette.

DE-80 requires no modification to the TRS-80 or CTR recorder so the Radio Shack warranty is not violated for either device. The unit, available prepaid for $45 (check, money order, VISA or Master Charge), has a 90-day warranty and a 30-day money back guarantee.

Contact Microsette Co., 777 Palomar Ave., Sunnyvale, CA 94086. *Circle No. 134*

Programmable Calculator with Constant Memory

Texas Instruments announced a new programmable calculator with Constant Memory, allowing the calculator to retain program steps, memory partitioning information and data when turned off. Memory retention eliminates the need to reenter data or programs for repetitive operation.



TI-58C allows a maximum of 480 program steps or up to 60 memories, depending on individual program requirements. The calculator can also use

Solid State Software modules including the Master Library Solid State Software modules (which comes with the calculator) or any one of 11 other optional modules. Solid State Software modules contain up to 5000 program steps. Optional libraries offer the user access to a large number of programs without writing extensive software.

The TI Programmable 58C uses TI's AOS operating system, which allows entry of problems in algebraic notation just as they are normally written. Up to nine sets of parentheses are allowed with up to eight pending operations performed according to the rules of algebraic hierarchy.

A program can have up to six levels of subroutines, and there are 72 usable labels. Users can address programs by absolute, indirect or label methods, and address data-memories using direct or indirect methods. Program editing is facilitated by delete, single-step, backstep and no-operation instructions. Over 170 functions and operations in scientific, engineering and statistical fields are accessible from the calculator's keyboard.

Suggested retail price is $125. For more information contact Texas Instruments Inc., Consumer Relations, (Attn: TI-58C), P.O. Box 53, Lubbock, TX 79408. *Circle No. 135*

Upper/Lower Case for Apple

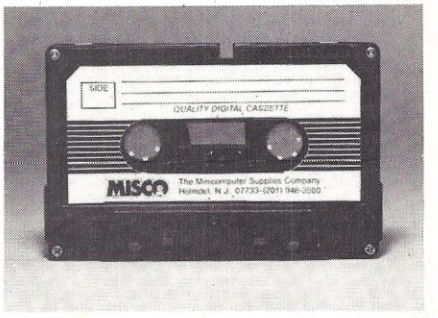
Appleshift is a package containing instructions for hardware modification of your Apple keyboard, machine language subroutines for input and screen display (lower case letters appear on your screen as upper case letters in normal mode; lower case letters appear as upper case letters in inverse mode) and an Integer BASIC demonstration program called Textpage.

Textpage allows you to enter, edit, store on disk and print (using your own driver) 55 lines of 80 characters. Disk Textpage requires a DOS system with at least 24K. The tape version (available with listings only, no tape) needs 16K.

Appleshift is available for $29.95. For more information contact C&H Micro, P.O. Box 2161, Glen Ellyn, IL 60137. *Circle No. 136*

Digital Cassette for Micros

A new Misco digital cassette for microcomputers is designed as a replacement for audio tapes in units such as the TRS-80, Apple II, PET and Ohio Scientific.



The Misco cassette gives consistent, long-lasting recording, said the company. Quality digital tape, 1600bpi tested, provides ten minutes of recording and is leaderless for instant play. Each cassette comes in a plastic storage box.

For more information, including a free catalog of computer supplies and accessories, contact Misco, Inc., 963 Holmdel Rd., Box 399B, Holmdel, NJ 07733; (201) 946-3500. *Circle No. 138*

Continuous Business Forms And Letterhead

Alpha Supply Company's continuous business forms include a payroll/voucher check, statement/invoice, legal pleading form and continuous business and personal letterhead. All standard forms are 9½" wide, permitting use with most fixed width printers, said the company.

The forms can be custom-imprinted in quantities as small as 250 forms, thus eliminating the need to purchase custom forms in minimum runs of 2500 to 5000 forms. A small business can now have custom business forms for less than the cost of a specially designed form, Alpha said. Continuous forms are available immediately. Custom imprinting requires 2 to 4 weeks.

Prices range as follows: payroll/voucher checks, from $89.50 for 250 to $142.50 per thousand for 5000; continuous statements, from $64.01 for 250 to $95.72 per thousand for 5000 (color costs extra); continuous letterheads, from $46.32 for 500 to $52.58 per thousand for 5000 (on white #18 bond; color and other paper stocks cost extra).

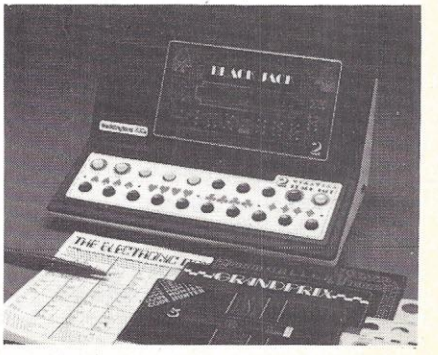
For more information contact Alpha Supply Co., 9625 Mason Ave., Unit 8, Chatsworth, CA 91311; (213) 882-9818. *Circle No. 139*

Game Machine/Calculator

The Game Machine, a microprocessor-based electronic game from Waddington's House of Games, contains four games and a four-function calculator.

The machine monitors game play, keeps track of scoring and initiates audio-visual effects.

The four games are: Shooting Gallery, a 30-shot target game; Black Jack; Code Hunter, in which you break the hidden four-digit code; and Grand Prix, a two-minute auto race game.



The Machine measures 11" x 6-3/4" x 5½" and operates on 6 C cells or an AC Adaptor (not included). Score pads are included.

Price for the machine, available in department stores, is about $60. For more information, contact Waddington's House of Games, Inc., 2633 Greenleaf, Elk Grove Village, IL 60007; (312) 640-1776. *Circle No. 140*

P.C. BOARDS

TRS-80 Software Listing

The first issue of the TRS-80 Software Source from ComputerMat, published three times a year, offers 2400 listings from 125 suppliers.

The Source is divided into four sections: Supplier-Alphabetized; Category and Subject-Alphabetized; Basic,

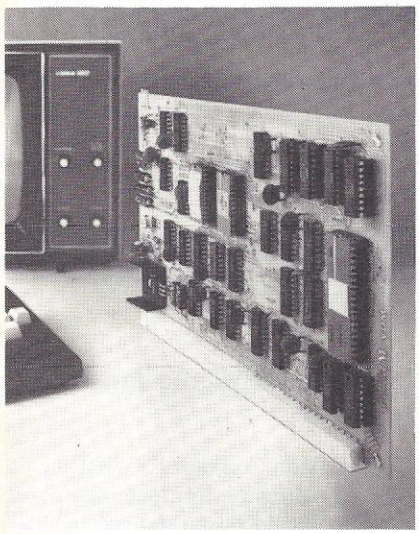
Level and Memory-Alphabetized; Supplier Listing-Name, Address and Phone.

Subscription rates are: 1 year (until July 31), $10; 1 year (after Aug. 1), $12. Add $5 outside North America. Single issue (until July 31, 1979), $3.95; single issue (after Aug. 1, 1979), $5. Add $2 outside North America.

For more information contact ComputerMat, Box 1664, Lake Havasu City, AZ 86403; *Circle No. 141*

Programmable Video Display Board

Percom Data Company announced an SS-50 bus, a video display board. The board offers text and word processing value because the effects of editing and line justification are instantly visible.



Called the Electric Window, the device is memory-resident, programmable and displays up to 24 80-character lines. With the Electric Window, the operator can observe the memory space where characters are being input and manipulated, according to the company.

Other features include two character generators (standard characters and specially-programmed characters); dual density, high-lighting alphanumeric display; display scrolling controlled by a single programmable register; descenders on lower case letters; and programmable display positioning.

Electric Window is compatible with standard video monitors, said the company. An included instruction manual has a complete operating system listing. An optional PROM operating system is also available.

Electric Window sells for $249.95 and may be ordered by dialing Percom's toll-free number: 1-800-527-1592. Orders may be paid by check or money order, or charged to Visa or Master Charge accounts. Texas residents must add 5% sales tax.

For more information contact Percom Data Company, Inc., 211 N. Kirby, Garland, TX 75042; (214) 272-3421. *Circle No. 142*

TRS-80 Music Board and Speed Selection Board

For music applications, Mumford Micro Systems offers an assembled, pitch-generating board for the TRS-80, called MB-1. Compared to software music programs, the board has higher pitch accuracy, may be tuned to any reference without affecting scale accuracy and requires only one statement to produce a given note, according to the company.

The board interprets 48 different numerical values to produce notes in a four-octave chromatic scale. Pitches are produded by an onboard clock and digital divider. Two boards may be used for harmony. The board is addressed in Level II with the OUT port command and is addressible in Level I with machine code.

MB-1 comes with a demonstration program on cassette which plays an Irish tune and allows reprogramming other sequences in an intelligible manner (note, octave, duration), as well as suggestions for computer compostion and sound effects.

The price for the board without power supply or speaker, but with jacks for both, is $74.95. Mounted in a mahogany cabinet with speaker, volume control and power supply, the unit sells for $94.95. Add $1 for postage; California residents add 6% tax.

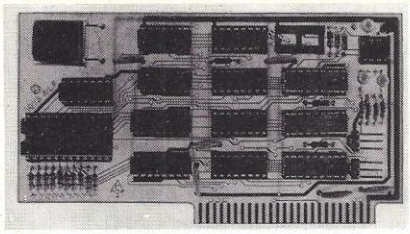
Also available from Mumford is a board which allows users to select from three operation speeds: 1.77 MHz (normal), 2.66 MHz (50 percent increase) or 880 KHz (50 percent decrease).

Speeds can be switched at any time without interrupting program execution. SK-1 comes with all components, switches and illustrated instructions for $24.95, kit; or $29.95, assembled. Add $0.75 for postage; California residents add 6% tax.

For more information contact Mumford Micro Systems, Box 435-D, Summerland, CA 93067; *Circle No. 143*

Apple Music Synthesizer

A complete music synthesizer which plugs into your Apple II computer and your home stereo system is designed for use by both musicians and hobbyists. The synthesizer features three independent voices (6 or 9 voices using 2 or 3 units), an eight-octave range (which includes the full piano range), 24 or more notes per octave, accurate crystal-controlled tuning and volume/envelope control.



Software for the synthesizer ranges from simple driving routines to an interactive-graphics music entry system which allows you to enter sheet music without using complex "music language". Five sample songs are included on the software cassette. The unit is supplied fully assembled and tested, with an extensive owner's manual, software cassette, circuit card and audio output cable.

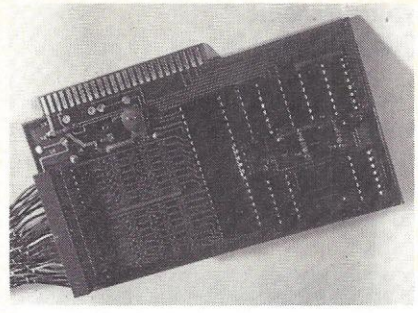
List price is $265, and the unit is available at local Apple dealers. For more information contact ALF Products Inc., 128 South Taft, Denver, CO 80228; (303) 234-0871. *No circle number.*

16-Channel Input Card for Apple II

Interactive Structures, Inc., announced its AI-02 Analog Input Card which allows homeowners to input data into their Apple II computers.

Sixteen analog channels may be monitored by the system with eight-bit resolution. Channels are individually addressable and conversion time is 70 microseconds. The system, which can be operated from BASIC, also provides interrupt capability.

The AI-02 price is $260. For more



information contact Interactive Structures, Inc., Suite 204, Science Center, 3401 Market Street, Philadelphia, PA 19104; (215) 382-8296. *Circle No. 144*

LITERATURE

New England Microcomputer Directory

The Boston Computer Society announced a directory for locating microcomputer products and services in New England. *The First New England Microcomputer Resource Handbook* lists and describes computers, peripherals, software, retailers, repair organizations, courses, clubs, user groups, user publications and trade journals.

Home, school, business and laboratory computer users can compare costs and features of computers, as well as services and support by local vendors, according to the Society. Novices to microcomputing can locate stores, clubs and courses.

The Handbook is priced at $2. For more information contact the Boston Computer Society, 17 Chestnut St., Boston, MA 02108. *Circle No. 145*

Digitizer Brochure

A new eight-page, four-color brochure describing the HI Pad Digitizer is available from Houston Instrument. This 11-inch by 11-inch active surface digitizer offers user controllable features such as metric/inch capability, binary/BCD outputs and RS-232C/8-bit parallel interface.

HI Pad is accurate to plus or minus 0.015 inches with a resolution of either 0.01 or 0.005 inches. The data rate may be set to input up to 100 coordinate pairs per second. Four buttons on the edge of the table allow the user to relocate the origin and select point or stream modes of operation.

The magnified cursor allows coordinate updating at the curve or line being traced by merely depressing the cursor button at points being considered.

HI's brochure includes prices, specifications and accessories as well as complete technical descriptions of the multiple output formats available.

For more information contact Gabrielle C. Ryan, Houston Instrument, One Houston Square, Austin, TX 78753; (512) 837-2820. *Circle No. 146*

1979 Catalog and Buyer's Guide

Ohio Scientific, Inc., has published its new 1979 Full Line Catalog. According to the company, the catalog was edited to tell "Everything you've always wanted to know about personal and small business computers." This 5-1/2" × 7-1/4" catalog and buyer's guide is available in two parts, with the 310-page paperback handbook supported by a 16-page price list supplement.

Through introductory chapters on personal computers, a series of Ohio Scientific Challenger technical reports and reviews of available software, this catalog covers a wide range of personal and small business computer applications, including capability of upgrading systems for future expansion.

The catalog with price list is on sale at Ohio Scientific dealers for $1 per set. The catalog set may also be ordered direct by sending $1 to Ohio Scientific, Publications Dept., 1333 South Chillcothe Road, Aurora, OH 44202. *Circle No. 147*

Apple Software Directory

The Apple Software Directory from WIDL Video, designed as a reference book, alphabetically lists over 700 software programs with description, memory requirements, price, format and source.

The directory is printed in two volumes. Volume I covers business and utility programs; Volume 2 covers games and entertainment programs. Each volume is priced at $4.95.

For more information contact WIDL Video, 5325 N. Lincoln, Chicago, IL 60625. *Circle No. 148*

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Professor George Zimmerman
Department of Physics
Boston University
111 Cummington Street
Boston, MA 02215

Let The IRS Subsidize Your Personal Computer

PAUL SNIGIER

Want to become a home μC hobbyist? But are you looking upward at the steep costs of a home personal computer and find them a little too high for your wallet? Well, fellow μComputerists, let Uncle Sam subsidize your home computer.

Here's how. In a nutshell, if you use your μC in entrepreneurial fashion (for profit), the IRS allows an investment tax credit equal to 10% of your investment. But that's not all: Such assets can be depreciated, and you can deduct a portion of residence expenses if you operate a "lemonade" μC business out of your apartment or house.

So, if you buy a μC system and peripherals for $8K, you receive an investment tax credit of $800 in the year of purchase. This is credit, not a deduction, and is subtracted from your tax liability. To qualify for a full investment tax credit, a seven-year useful life for a μC is reasonable and conveniently falls within the asset depreciation guidelines established by the IRS.

What if your μC and μSystem has a useful life (as an asset) of more than three years but less than five? The IRS will allow only 33.3% of full credit. If the μC/μS life is more than five years but under seven, then the IRS will allow 66.7% of the full credit.

Then there's another tax benefit: The IRS allows depreciation to be deducted as if it were being stashed away (theoretical slush fund); the amount is deducted from income to determine the tax liability (as opposed to the investment tax credit, which is subtracted once tax liability is found). If your system has a salvage value of $1K at the end of seven years, then depreciation is $1K/year and may be deducted.

What qualifies for an expense? Software does; however, if purchased as a package with hardware it must be depreciated over the hardware life.

Other expenses include telephone, trade journals (Personal Computing, etc.) postage, stationary, mileage, employee wages and a portion of your residence expenses. To prove this, collect proof to establish that your home business is used exclusively and regularly as a principal place of business (that is, not for playing Star Trek). If your lemonade business uses one of four rooms, and at $4K residence expenses, then the pro rata portion equals $1K. Not bad?

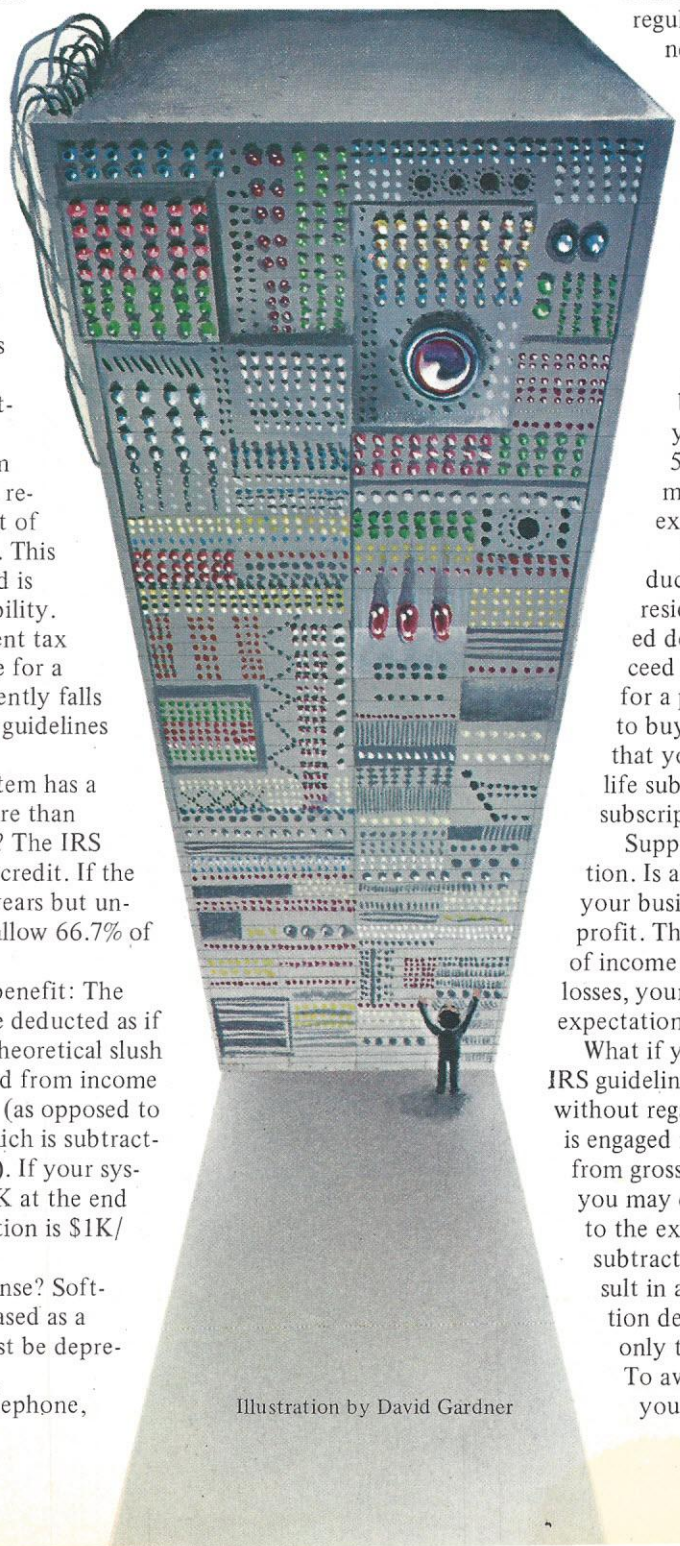

Illustration by David Gardner

Now, the key question: How do you qualify as a business and not a hobby? Simple. If you can make money in two of five years, you are engaged in an activity for profit. How? Count backwards using the present tax years as the fifth year. File Form 5212 (Election to postpone determination) and Form 5214 (Consent extending period of limitation).

Be careful not to overdo your deductions. If deducting a portion of residence expenses or using accelerated depreciation, and deductions exceed income, it's not a business looking for a profit. Wait until the year's end to buy that life subscription; if it seems that you're going to net $100 and the life subscription is $150, then order the subscription in the following year.

Suppose you fail to meet the presumption. Is all lost? No, you can still qualify your business as an activity engaged in for profit. The IRS will consider your history of income and losses, amount and cause of losses, your skills and financial status, plus expectation of profit.

What if you get careless and fail to meet IRS guidelines? Some deductions are allowed without regard to whether or not an activity is engaged in for profit and are subtracted from gross income. If any income is left, you may deduct other expenses, but only to the extent that income is still left. Next, subtract other expenses which do not result in adjustment to basis (nondepreciation deduction may be deducted, but only to the extent of such income. Most To avoid miscalculations, why not visit your accountant – before you start?

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